SAFE ROUTES TO SCHOOL
Volume 1: Study Overview and Summary of Results

Report to the Legislature

CALIFORNIA
DEPARTMENT OF TRANSPORTATION

Prepared Pursuant to
Streets and Highways Code
Section 2333.5

December 2003

EXECUTIVE SUMMARY

Background

The SR2S program was authorized by AB 1475 in 1999 and reauthorized by SB 10 in 2001. The program provides funding for construction projects near schools, with the intent of increasing pedestrian and bicyclist safety and improving the environment for non-motorized transportation to and from school.

This report evaluates the success of the SR2S program, as required by the authorizing legislation. While the legislative intent requires that this study have an emphasis on accident reduction, we note that a study of changes in accident rates resulting from SR2S construction is not yet possible, since research would have to track accident rates for several years after SR2S construction to infer an impact. For that reason, this study focuses on characteristics of vehicle traffic and pedestrian and bicycle traffic that are associated with pedestrian accidents. The data here include information on the yielding of vehicles to non-motorized traffic, vehicle counts, and vehicle speeds, all of which can be examined for changes that would correlate with improvements in pedestrian or bicyclist safety. The research team also observed the numbers of child pedestrians and bicyclists, and whether those pedestrians/bicyclists used a sidewalk, path, street, or shoulder. In addition to that, the research team distributed a survey to parents of schoolchildren at selected SR2S schools before and after SR2S project construction.

Study Design and Methods

The research team collected baseline (pre- SR2S project construction) and post- SR2S project construction data for each of sixteen elementary school sites. Of the sixteen schools studied, full before and after data are only available for nine schools. At the other seven schools, SR2S project construction was not completed in time to be included in this report.

SR2S Study Sites

	City/County	Caltrans District	County	School Name	Improvement
1	City of Bell Gardens	7	Los Angeles	Cesar Chavez Elementary	Install traffic signal
2	City of Chino	8	San Bernardino	Newman Elementary	Install traffic signal
3	City of El Sobrante	4	Contra Costa	Sheldon Elementary	Construct sidewalk gap closures
4	City of Encinitas	11	San Diego	Ocean Knoll Elementary	Construct sidewalks
5	City of Glendale	7	Los Angeles	Glenoaks Elementary	Install in-pavement crosswalk signal system to alert approaching vehicles of children in the crosswalks
6	City of Gonzales	5	Monterey	La Gloria Elementary	Install sidewalks and bikeways, traffic signal, signs and pavement markings, traffic calming and traffic diversion
7	City of Malibu	7	Los Angeles	Juan Cabrillo Elementary	Construct pathway of decomposed granite, bordered by wood curb, with appropriate signage
8	City of Murrieta	8	Riverside	Murrieta Elementary	Install bike lanes, sidewalk, curb, gutter
9	City of Oakland	4	Alameda	Hawthorne Elementary	Construct sidewalk bulbout, pedestrian head
10	City of Rancho Cucamonga	8	San Bernardino	Jasper Elementary	Install pedestrian-activated flashing warning signal system
11	City of San Bernardino	8	San Bernardino	Mt. Vernon Elementary	Install traffic signal system
12	City of Santa Clarita	7	Los Angeles	Sulphur Springs Elementary	Construct pedestrian bridge over creek, construct sidewalk
13	City of South Gate	7	Los Angeles	Montara Elementary	Install flashing safety signal for pedestrian crossings, replace deteriorated sidewalk, install new street safety signal at crosswalks, install speed humps
14	City of Whittier	7	Los Angeles	Evergreen Elementary	Construct sidewalk and disabled access ramps around Evergreen Elementary School
15	City of Yucaipa	8	San Bernardino	Valley Elementary	Install sidewalk gap closures
16	San Bernardino County	8	San Bernardino	West Randall Elementary	Install sidewalk gap closures

The SR2S projects at these sites are representative of six different project work types, as shown below.

Work Type	Schools
Sidewalk improvements	Sheldon Elementary, West Randall Elementary (primarily sidewalks) Murrieta Elementary, Valley Elementary, La Gloria Elementary (includes other work types) Juan Cabrillo Elementary, Ocean Knoll Elementary
Traffic calming & speed reduction	La Gloria Elementary, Hawthorne Elementary
Pedestrian/bicycle crossing	Mt. Vernon Elementary, Jasper Elementary, Valley Elementary, Glenoaks Elementary
Bicycle facilities (on-street or off-street)	La Gloria Elementary, Murrieta Elementary
Traffic control devices	Cesar Chavez Elementary, Newman Elementary
Traffic diversion improvements	La Gloria Elementary, Sulphur Springs Elementary

Note: Most projects with multiple work types are shown in multiple categories.

Traffic data were collected at each school location by a team of three or four observers. Those researchers recorded information on vehicle counts, vehicle speeds, yielding of vehicles to non-motorized traffic and vice versa, and the number of pedestrians and bicyclists both before and after the SR2S project was constructed. Information was also collected on the urban design, or physical character, of the neighborhood surrounding each school, emphasizing aspects of the neighborhood design that might facilitate or impede overall walking.

As part of this research, investigators also surveyed parents of children in the 3rd through 5th grade at each school in the study. The survey was distributed before construction of the SR2S project, to get baseline data on school demographics and child travel patterns to and from school, and again after SR2S construction to measures changes in child travel patterns to or from school. In addition, the survey distributed to 3rd through 5th grade parents after SR2S construction included a battery of questions to assess parental opinion about the effectiveness of the SR2S construction project.

Expected and Measured Effects

The research team expected that different SR2S projects would produce different effects. The tables below show the expected impact and measured result for each project. The evaluation hinged in part on whether the measured impacts were consistent with the expected impacts.

Project Description and Expected Impact

Project Information			Expected Impacts				
			Walking/Bicycling Impacts		Traffic Impacts		
Project Type	School	Project Description	Amount	Location	Vehicle Counts	Vehicle Speed	Yielding
Traffic Control Devices	Cesar Chavez Elementary	Traffic light replaces 4-way stop sign	+ (?)	None	- (?)	-	+
Pedestrian/Bicycle Crossing	Glenoaks Elementary	In pavement crosswalk lighting	+ (?)	None	None	- [a]	+
Pedestrian/Bicycle Crossing	Jasper Elementary	In pavement flashing warning light [b]	+	None	None	-	+
Sidewalk Improvements	Juan Cabrillo Elementary	Pathway of decomposed granite with wood curb	+	On sidewalk	None	None	None
Pedestrian/Bicycle Crossing	Mt. Vernon Elementary	Pedestrian "countdown" crossing light [c]	+ (?)	None	None	None	None
Sidewalk Improvement and Bicycle Facilities	Murrieta Elementary	Sidewalk and bicycle path construction	+	On sidewalk	None	None	None
Sidewalk Improvements	Sheldon Elementary	Sidewalk gap closures (about 400 feet)	+	On sidewalk	None	None	None
Sidewalk Improvements and Pedestrian/Bike Crossing	Valley Elementary	Sidewalk gap closures (3,000 ft.) and crosswalk	+	On sidewalk	None	- (?)	+
Sidewalk Improvements	West Randall Elementary	Sidewalk gap closures (about 2,200 feet)	+	On sidewalk	None	None	None

Notes: "Location" refers to walking only, and whether walking occurs on sidewalk/path or street/shoulder. For location, "on -sidewalk" indicates an expected increase in walking on a sidewalk or path. Yielding refers to yielding of vehicles to pedestrians/bicyclists only. Expected impacts denoted by "?" are less strongly expected.

[a] At Glenoaks, note that traffic at the location of the crosswalk lighting system in front of the school, was congested before the improvement, which reduces the likelihood of further reductions in vehicle speeds.

[b] No traffic signal or 4-way stop was located at this intersection, before or after SR2S project construction. The warning light is in-pavement lighting.

[c] A pre-existing traffic light was located at this intersection. Pedestrian "countdown" light shows time remaining before light changes.

Note that the following project types are represented in the before/after analysis: Sidewalk Improvements, Pedestrian/Bicycle Crossings, Traffic Control Devices, and Bicycle Facilities. Two types of projects are not represented in the before/after analysis: Traffic Calming and Traffic Diversion. The study sites for those two project types (La Gloria, Hawthorne, and Sulphur Springs) had not finished SR2S project construction by the time data were analyzed for this report.

Project Description and Measured Impact

School	SR2S Work Type	Project Description	Evidence of Success	Summary of Measured Results and Comments
Cesar Chavez Elementary	Traffic Control Device	Traffic signal at intersection that previously had no signal	Strong evidence of success	Increase in yielding of vehicles to pedestrians; decrease in vehicle speed; in area with high amounts of walking (walk/bike mode split at school approximately 50%)
Glenoaks Elementary	Pedestrian/ Bicycle Crossing	In-pavement crosswalk lighting	Strong evidence of success	Increase in yielding of vehicles to pedestrians; pedestrian counts show increase in walking
Jasper Elementary	Pedestrian/ Bicycle Crossing	In-pavement crosswalk lighting	No evidence of success	No change in yielding of vehicles to pedestrians; simultaneous opening of I-210 Freeway extension confounds measurement for this project, as I-210 appears to have diverted traffic from SR2S site, which could be associated with the observed increase in vehicle speeds at SR2S site
Juan Cabrillo Elementary	Sidewalk Improvement	Walking path	Weak evidence of success	Shift in walking from street/shoulder to path, but little walking was on street or shoulder before SR2S construction; low walking rates (walk/bike mode split from 5% to 7%) and most pedestrians are children and parents who drove to school, park down the street, and then walk into school
Mt. Vernon Elementary	Pedestrian/ Bicycle Crossing	Pedestrian warning light at intersection that already had traffic signal	No evidence of success	No change in amount of walking; project's main effect might have been convenience, which is not well measured by the objective outcome indicators summarized here
Murrieta Elementary	Sidewalk Improvement and Bicycle Facilities	New sidewalks and on-street bicycle paths	No evidence of success	Very low walking/bicycling amounts before and after SR2S project construction

School	SR2S Work Type	Project Description	Evidence of Success	Summary of Measured Results and Comments
Sheldon Elementary	Sidewalk Improvement	Sidewalk gap closures	Strong evidence of success	Shift in walking from street/shoulder to path (34% of observed child pedestrians on sidewalk before SR2S project, compared with 65% on sidewalk after SR2S project); fast vehicle speeds on adjacent road (average from 30 to 40 mph) suggests large increase in safety from separation of pedestrians and vehicles; some evidence of increase in amount of walking
Valley Elementary	Sidewalk Improvement and Pedestrian/ Bicycle Crossing	Sidewalk gap closures and new crosswalk	Strong evidence of success	Shift in walking from street/shoulder to path (58% of observed child pedestrians on sidewalk before SR2S project, compared with 96% on sidewalk after SR2S project)
West Randall Elementary	Sidewalk Improvement	Sidewalk gap closures	Strong evidence of success	Shift in walking from street/shoulder to path (25% of observed child pedestrians on sidewalk before SR2S project, compared with 95% on sidewalk after SR2S project); high levels of walking before and after project; walking increased after SR2S project

Schools were classified as having strong evidence of success if the measured outcomes corresponded to expected outcomes, if the measured outcomes exceeded the sample error in the survey data or the estimated human error in data collection (as appropriate), if the data provide a consistent indicator of project success, and if the magnitude of impact was reasonably large. The research team found strong evidence of success at five of the nine schools studied (Cesar Chavez Elementary, Glenoaks Elementary, Sheldon Elementary, Valley Elementary, and West Randall Elementary).

Note that the above criteria for success are possibly overly strict. These criteria require that a project produce a near-term, measurable impact that can be observed. Projects that contribute to behaviors that cannot be easily measured but that contribute to safety would not be ranked as a success by these criteria. A simple examination of projects classified as having "strong evidence of success" likely understates the success of the SR2S program. The research team believes that the fact that five of nine projects received a ranking of "strong evidence of success" suggests that the SR2S program on the whole was highly successful. The criterion for overall program success should not be that all SR2S projects deliver immediate and unambiguously measurable impacts, as that would not be possible even in the best of circumstances.

Evidence of Success by Work Type

Among the five sidewalk improvement projects studied, the SR2S sidewalk improvements at three schools (Sheldon, Valley, and West Randall) showed strong evidence of success. In all three cases, the success of the project was based primarily on large improvements in separating pedestrian traffic from vehicle traffic. Of the four schools with pedestrian/bicycle crossing improvements, the SR2S project at two schools (Glenoaks Elementary and Valley Elementary) showed strong evidence of success. The success of the project at Valley Elementary is based more on the sidewalk improvements than on the crosswalk. Thus, the only school where there is strong evidence of success for a pedestrian/bicycle crossing improvement is Glenoaks Elementary. The traffic control device, a traffic signal at Cesar Chavez Elementary, showed strong evidence of success. The only bicycle facility, on-street bicycle paths near Murrieta Elementary, showed no evidence of success. Overall, the most successful work types, based on the data summarized above, appear to be sidewalk gap closures in areas with pre-existing pedestrian traffic or traffic signals in areas with large amounts of both pedestrian or vehicle traffic.

Parental Opinion

The SR2S projects fare very well when measured by parental opinion. Large majorities of parents at all schools noticed the project, stated that the project would increase safety, and had a favorable opinion of the project.

Conclusions and Recommendations

Given the strong parental approval of the SR2S projects and the encouraging changes in traffic, pedestrian, and bicycle traffic, the research team concludes that the SR2S construction program has been successful in meeting its goals. It is the recommendation of the research team that the SR2S program be continued. Other recommendations include the following:

- Sidewalk gap closures near schools with moderate or high amounts of walking appear to be strong candidates for SR2S funding. Such projects are especially likely to produce increases in pedestrian safety.
- Traffic control projects that regulate yielding at intersections where large volumes of vehicle and pedestrian traffic intersect also are good candidates for SR2S funding.
- At schools where there are low levels of walking or bicycle travel, SR2S construction by itself will likely not be sufficient to increase non-motorized travel to or from school. At such locations, SR2S construction funding should be coupled with more intensive education campaigns or additional construction improvements at the schools to encourage students to walk or bicycle to school.
- In general, schools should be encouraged to leverage SR2S funds by providing education that encourages students to walk and bicycle safely to and from school. Including participation in National Walk to School Day as a criterion for evaluating applications for SR2S funding is one way to couple education more tightly with the construction program.

The research team also recommends that future research should continue to track the outcome of SR2S construction programs. Such research can examine more long-term outcomes of SR2S construction. One example would be studies that would track accident rates, taking advantage of longer time series than were available at the time this evaluation was conducted.

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INTRODUCTION

This document describes an evaluation of the California Safe Routes to School (SR2S) construction program conduced by the University of California, Irvine under contract to the California Department of Transportation. An expanded version of the contract was made possible by funding from the University of California Transportation Center, through a grant to UC-Irvine. The University of California Transportation Center funds supported an increase in the number of study sites beyond the number funded by the Caltrans contract, including study sites in the San Francisco Bay Area. The principal investigator for this research is Professor Marlon Boarnet in the Department of Planning, Policy, and Design at UC-Irvine, with co-investigators Professor Kristen Day (Department of Planning, Policy, and Design, UC-Irvine) and Dr. Craig Anderson (Health Policy Research, UC-Irvine). Several UC-Irvine students provided assistance throughout this evaluation, including Tracy McMillan, Mariela Alfonzo, Chris Boyko, Gia David, Luis Escobedo, Eric Gage, Jennifer Kunz, Layal Nawfal, Meghan Sherburn, C. Scott Smith, Irene Tang, and Priscilla Thio.

The SR2S program was authorized by AB 1475 in 1999 and reauthorized by SB 10 in 2001. The program provides funding for construction projects near schools, with the intent of increasing pedestrian and bicyclist safety and improving the environment for non-motorized transportation to and from school. This report evaluates the success of the SR2S program, as required by the authorizing legislation. The authorizing legislation required the California Department of Transportation to "study the effectiveness of the program … with particular emphasis on the program's effectiveness in reducing traffic accidents and its contribution to improving safety and reducing the number of child injuries and fatalities in the vicinity of the projects" (Section 2333.5(d) of California Streets and Highway Code, as amended by AB 1475). The re-authorization of the SR2S program in 2001 (SB 10) required the Department of Transportation to submit the study to the legislature by December 31, 2003.

While the legislative intent requires that this study emphasize accident reduction, a study of changes in accident rates resulting from SR2S construction is not yet possible. Pedestrian and bicycle accidents are rare events, and tracking the effect of SR2S construction on accident rates would require a time series of accident data likely extending for several years before and after the project construction. The research team estimated that, at a minimum, two years of accident data would be needed after SR2S construction to accurately assess changes in accident rates that could be attributed to the program. This left few opportunities for study. The first cycle of SR2S funds were allocated in Fall of 2000, such that only the earliest of those projects would have been completed quickly enough to allow a full two years of post-construction observation of accident data. More generally, delays in reporting accident data and the fact that even the first cycle of SR2S projects were not required to sign a construction contract until Fall of

2001 made an analysis of accident data infeasible within the timeframe required to deliver a report by the December 31, 2003 deadline.

For that reason, this study focuses on characteristics of vehicle traffic and pedestrian and bicycle traffic that are associated with pedestrian accidents, rather than on accidents themselves. Presented here are detailed data on nine school sites before and after SR2S construction at those sites. The data here include information on the yielding of vehicles to non-motorized traffic, vehicle counts, and vehicle speeds, all of which can be examined for changes that would correlate with improvements in pedestrian or bicyclist safety. The research team also observed the numbers of child pedestrians and bicyclists, and observed whether those pedestrians/bicyclists used a sidewalk, path, street, or shoulder. These observations provide information on whether the SR2S program contributed to the separation of non-motorized and motorized traffic. In addition, the research team distributed a survey to parents of schoolchildren at selected SR2S schools before and after SR2S project construction. This survey provides more information on changes in children's travel patterns and on parents' perceptions of the effectiveness of the SR2S program and its contributions to pedestrian and bicyclist safety. Lastly, the research team cataloged the urban design near school neighborhoods, to provide information about the context of the built environment near the construction projects as a possible influence on walking.

Background of SR2S Program

California created the first state-level SR2S construction program in the United States in October 1999, with the signing of California Assembly Bill 1475 (AB1475). The Bill authorized the allocation of $40 million in federal transportation funds over two years to fund projects that were intended to increase the safety and physical activity of child pedestrians and bicyclists on routes to school by altering traffic conditions for vehicles, pedestrians and bicyclists. The program focused on construction projects, as opposed to public information or education. It was supported by a broad coalition of transportation, physical activity, injury and urban design advocates. The original two-year program was re-authorized in 2001 for three more years under California Senate Bill 10.

At the time this report was being prepared, the program had completed three application cycles and approved funding for more than 270 projects. The SR2S program is a "reimbursement program," meaning that successful applicants are reimbursed for their costs in arrears. The maximum reimbursement ratio is 90% with the local agency providing a 10 percent minimum local match. The maximum reimbursement amount for any single project is $450,000. Over $66 million of federal funds have been used to support the program thus far. The number of projects awarded, total project costs, and the federal share of project costs for each funding cycle are outlined in Table 1**.**

Table 1: Safe Routes to School Project Awards, 1999-2003

	Number of applications	Number of project awards	Total project cost	Federal share
1st cycle (Fall 2000)	719	85	$25,150,032	$19,859,331
2nd cycle (Fall 2001)	520	101	$27,266,117	$24,328,658
3rd cycle (Fall 2002)	427	87	$28,814,521	$22,130,419
Totals	***1666***	***272***	***$81,230,670***	***$66,318,408***

The list of approved projects for the 4th cycle is expected to be released in the fall of 2003. Visit the Caltrans Safe Routes to School Web Site at www.dot.ca.gov/hq/LocalPrograms/saferoute2.htm for additional program information.

The most common types of projects awarded across the first three cycles of SR2S projects were pedestrian/bicycle improvements (e.g., installation or widening of bicycle lanes, crosswalks, flashing beacons and/or traffic signals) and sidewalk improvements (e.g., installation or reconstruction of sidewalks and/or curb ramps). Table 2 contains a breakdown of the projects by improvement type awarded in the first three cycles of SR2S funding.[1]

Table 2: Summary of California SR2S Projects by Type of Improvement

Type of improvement	1st cycle, Fall 2000 N = 85	2nd cycle, Fall 2001 N=101	3rd cycle, Fall 2002 N=87
Sidewalk improvements	45	60	66
Pedestrian/ bicycle improvements	55	78	59
Traffic diversion improvements	2	6	2
Traffic calming interventions	8	13	10

California's SR2S program, based on legislation to support engineering changes, has spawned similar programs in other states, including Oregon, Washington, Texas, and Delaware. Still other localities, such as Tallahassee and Clearview, Florida; Atlanta, Georgia; Chicago, Illinois; and Arlington, Virginia are investing funds in the education of children, parents, and

[1] Most projects contain multiple improvements and/or multiple school sites. Therefore, the number of improvements given in the table exceeds the total number of projects awarded. The table reflects the classification of all proposed improvements.

communities on walking and bicycling safety or in enforcement of traffic laws around schools (Transportation Alternatives, 2002). The National Highway and Traffic Safety Agency (NHTSA) and the Centers for Disease Control and Prevention (CDC) have invested resources in safer, more pedestrian- and bicycle-oriented routes to school in the form of internal and external program dollars. National organizations, such as the Surface Transportation Policy Project, the American Planning Association, and the American Public Health Association, currently advocate for national legislation to support the concept of safe walking and bicycling routes to school.

METHODS

Study Design

The California SR2S construction program provides a unique oppportunity to observe how changes to the street, sidewalk, and bikeway environment can influence non-motorized travel and pedestrian/bicyclist safety. The research team conducted a pre- and post-evaluation of selected California SR2S sites to determine the effectiveness of physical changes to the local environment in (1) improving the perceived and actual safety of the walk and bicycle trip to school, and (2) enhancing the viability of the walking and bicycling environment.

The research team collected baseline (pre- SR2S project construction) and post- SR2S project construction data for each of sixteen elementary school sites. These "before" and "after construction" data include information about traffic characteristics, walking and bicycling behavior, and perceptions of the safety of non-motorized travel. Three data collection techniques were used: (1) traffic data were collected by teams of observers, (2) the urban environment was measured by observing characteristics of the neighborhoods around study schools, and (3) child travel behavior and parental perceptions were measured through a survey distributed to parents of 3rd through 5th graders at each school studied. Following an initial description of the methods used to select the study sites, each data collection method is described.

Of the sixteen schools studied, full before and after data are only available for nine schools. At the other seven schools, SR2S project construction was not completed in time to be included in this report. Data collection is proceeding at the other schools as soon as construction is complete. A report of those findings will be delivered before the conclusion of the contract in June of 2004.

School Site Selection Criteria

Schools were selected based on the following criteria:

1. School type (elementary/middle/high school): Cycle 1 SR2S projects were overwhelmingly (70%) targeted toward elementary schools. Given this high percentage, a focus on elementary schools was deemed appropriate. Additionally, high schools typically serve students from a wide area, including those outside of feasible walking distance, making the opportunity for students to walk to high schools more limited. In addition, recruiting schools proved to be exceptionally time-consuming, and including students of different age ranges, such as middle or high-school children, would have required changes to the research design for schools that serve different ages. For these reasons, the study focuses only on elementary schools.

2. School setting: Most of the schools funded in the first two cycles of the SR2S program were located in suburban settings. Even urban schools, such as those in South Central Los Angeles, are classified by the U.S. Census as "urban fringe of a large city." The research team believe that there is variation across a broad range of settings in the sample of schools, including urban settings and more rural settings, but that variation is constrained by the fact that schools served by SR2S project funds were predominantly located in suburban settings.

3. Work type: The SR2S projects included in this overall study represent a cross-section of six work types funded by the SR2S program. The six work types are: sidewalk improvements, traffic calming and speed reduction, pedestrian and bicycle crossing, bicycle facilities, traffic control devices, and traffic diversion improvements. Projects that are typical of each work type include: sidewalk improvements (new sidewalks), traffic calming and speed reduction (speed humps), pedestrian and bicycle crossing (crosswalks or crosswalk improvements), bicycle facilities (bicycle paths, on or off the street), traffic control devices (traffic signals), and traffic diversion improvements (closing streets to traffic to create pedestrian walkways). These are examples of work types, rather than exhaustive list of possible projects in each work type category.

School Recruitment

Recruitment of elementary schools for participation in the research project began in the late fall of 2001/winter of 2002. Recruitment first targeted local agencies from the 1st cycle of SR2S funding. As recruitment occurred one year after the first awards had been announced, many of the 1st cycle SR2S projects would already be complete. Many other projects had not yet begun due to coordination with other related projects; delays in the design, review and bid process; or postponement until summer to minimize impacts on the school environment. The number of SR2S projects that anticipated construction in summer/fall of 2002 was somewhat limited (this construction schedule would allow for pre-construction data collection to occur within a timeframe not too distant from the proposed construction date.) The research team also avoided including in the sample those school sites that ere not yet in the development process of an SR2S project, because of the need to ensure that post-construction data collection would occur within the research timeline.

The research team began to contact local agencies from the 2nd cycle of funding in the spring of 2002, as it became clear that recruitment from the 1st cycle that local agencies would be relatively low, primarily because of construction schedules. Nine schools were recruited from the 2nd SR2S cycle (projects announced in the fall of 2002). It appeared that local agencies were more familiar with the mechanisms of the SR2S funding program in the

second year of its existence, which may have reduced the amount of time from project award to construction. Local agencies continued to be sensitive to construction effects on school day activities, so many planned for the majority of construction to occur during a school's off-period (i.e., summer or holiday breaks).

Recruitment of schools to participate in the study continued through the spring, summer and fall of 2002, including local agencies and then schools from both the 1st and 2nd cycle.

In contacting school sites, the research team became aware that many of the schools who were part of an SR2S project were not aware or did not recall the SR2S grant application being submitted by the administration at the school. This issue hampered recruitment at several schools. Low awareness of the SR2S project was likely due to several factors:

- The delay between when the grant was developed and when the actual project began (e.g., grants were written for the 1st cycle in the spring of 2000 and the research team contacted those projects that had not yet been constructed two years later)
- The administrator who was part of the SR2S grant development process was no longer at the school and information about the project was not transmitted to the new administrator
- Communication between the local agency submitting the SR2S grant application (the incorporated city or county where the school was located) and the school was lacking in the period between grant development and project construction. At one location in particular it was not clear whether the school supported the infrastructure improvements that were to be constructed to increase the safety and feasibility of students walking and bicycling to that school. In reviewing grant applications, it was not clear how much each school participated in the project development. At another location, a call by the research team to the school regarding data collection was the school's first indication that construction would be happening near the school within the next month.

The schools included in this study are listed below:

SR2S Study Sites

	City/County	Caltrans District	County	School Name	Improvement
1	City of Bell Gardens	7	Los Angeles	Cesar Chavez Elementary	Install traffic signal
2	City of Chino	8	San Bernardino	Newman Elementary	Install traffic signal
3	City of El Sobrante	4	Contra Costa	Sheldon Elementary	Construct sidewalk gap closures
4	City of Encinitas	11	San Diego	Ocean Knoll Elementary	Construct sidewalks
5	City of Glendale	7	Los Angeles	Glenoaks Elementary	Install in-pavement crosswalk signal system to alert approaching vehicles of children in the crosswalks
6	City of Gonzales	5	Monterey	La Gloria Elementary	Install sidewalks and bikeways, traffic signal, signs and pavement markings, traffic calming and traffic diversion
7	City of Malibu	7	Los Angeles	Juan Cabrillo Elementary	Construct pathway of decomposed granite, bordered by wood curb, with appropriate signage
8	City of Murrieta	8	Riverside	Murrieta Elementary	Install bike lanes, sidewalk, curb, gutter
9	City of Oakland	4	Alameda	Hawthorne Elementary	Construct sidewalk bulbout, pedestrian head
10	City of Rancho Cucamonga	8	San Bernardino	Jasper Elementary	Install pedestrian-activated flashing warning signal system
11	City of San Bernardino	8	San Bernardino	Mt. Vernon Elementary	Install traffic signal system
12	City of Santa Clarita	7	Los Angeles	Sulphur Springs Elementary	Construct pedestrian bridge over creek, construct sidewalk
13	City of South Gate	7	Los Angeles	Montara Elementary	Install flashing safety signal for pedestrian crossings, replace deteriorated sidewalk, install new street safety signal at crosswalks, install speed humps
14	City of Whittier	7	Los Angeles	Evergreen Elementary	Construct sidewalk and disabled access ramps around Evergreen Elementary School
15	City of Yucaipa	8	San Bernardino	Valley Elementary	Install sidewalk gap closures
16	San Bernardino County	8	San Bernardino	West Randall Elementary	Install sidewalk gap closures

These sixteen schools include seven schools from the 1st cycle of SR2S funding, of which one school was in Caltrans District 4, one in District 5, one in District 7, and four in District 8. The study schools also include nine that received funding in the 2nd cycle of the SR2S program, including one school from District 4, five from District 7, two from District 8, and one from District 11. By county, the study schools include one school in each of Alameda, Contra Costa, Monterey, Riverside, and San Diego Counties, five schools in San Bernardino County, and six schools in Los Angeles County.

The work types associated with these school sites are shown below:

Work Type	**Schools**
Sidewalk improvements	Sheldon Elementary, West Randall Elementary (primarily sidewalks) Murrieta Elementary, Valley Elementary, La Gloria Elementary (includes other work types) Juan Cabrillo Elementary, Ocean Knoll Elementary
Traffic calming & speed reduction	La Gloria Elementary, Hawthorne Elementary
Pedestrian/bicycle crossing	Mt. Vernon Elementary, Jasper Elementary, Valley Elementary, Glenoaks Elementary
Bicycle facilities On-street Off-street	La Gloria Elementary, Murrieta Elementary
Traffic control devices	Cesar Chavez Elementary, Newman Elementary
Traffic diversion improvements	La Gloria Elementary, Sulphur Springs Elementary

Note: Most projects with multiple work types are shown in multiple categories.

Traffic Observation Methods

Traffic data were collected at each school location by a team of three or four observers. The observations reported here are before construction measurements made at intersections where funded SR2S projects were intended to demonstrate an impact. An observer recorded the number of both child and adult pedestrians and bicyclists at the site, noting the streets crossed by each individual or group were noted. Pedestrians and bicyclists were counted if they crossed at the intersection, passed adjacent to the intersection, or crossed mid-block on a single pre-selected segment.

A second observer recorded yielding behavior of drivers, pedestrians, and bicyclists. That observer classified whether parties (vehicles, pedestrians, or

bicyclists) yielded as would be required by the California Vehicle Code. The yielding of vehicles to pedestrians or bicyclists is of particular interest in this study.

A third observer counted vehicles entering the intersection from one direction, or if volume was sufficiently low to permit it, from two directions. The number of vehicles turning right and left from each direction was also recorded.

A fourth observer used a stopwatch to calculate vehicle traffic speeds. A segment of street was chosen that began and ended at least 50 feet from any intersection. The total length of the segment was at least 200 feet, as measured with a measuring wheel. The time required for a vehicle to travel the measured segment was recorded by hand. As soon as the travel time was recorded for one vehicle, another vehicle was identified, timed, and recorded. The results of this method allowed the measurement of average travel times over the segment even when traffic was heavily congested.

Beginning with the tenth school, the same observer recorded both number of pedestrians and bicyclists and yielding behaviors. In the initial data collection at the first nine schools, the research team learned that one observer could easily record both pedestrian and bicyclist counts and yielding behaviors in all but the schools with exceptionally heavy pedestrian traffic. For those schools with heavy pedestrian traffic, a team of four persons was sent to complete the observations after SR2S project construction.

Traffic was observed from 30 minutes before to 15 minutes after the beginning of the school day, and from 15 minutes before to 30 minutes after the end of the school day. All observers recorded two-minute intervals in the raw data. Two ten-minutes periods were then used to summarize the data. The morning off-peak period is the first 10 minutes of morning observations (when traffic near schools is generally low), and the afternoon off-peak period is the final 10-minute of afternoon observations. For both morning and afternoon periods, the peak 10 minutes refers to the 10-minute period during the observations with the highest volume and lowest speed. Note that peaks are reported for vehicle counts, speeds, and pedestrian/bicycle counts. In all cases, the peak is the highest 10-minute period or, for vehicle speeds, the 10-minutes with lowest average speeds. These 10-minute mean vehicle speeds and vehicle, pedestrian, and bicycle counts were averaged over the two days of observation; thus, fractional counts are possible.

Urban Design Observation Methods

Information was collected on the urban design, or physical character, of the neighborhood surrounding each school in the sample, emphasizing aspects of the neighborhood design that might facilitate or impeded overall walking. The research team defined "neighborhood" as the sum of all blocks contained in part or whole within 1/4 mile of the primary school impacted by SR2S

construction project being observed. Blocks included both facing sides of the street. Each neighborhood includes a different total number of blocks, depending on its street pattern.

To record, describe, and categorize urban design, data collection teams walked each block within the neighborhood. Observers recorded the presence or absence of urban design elements hypothesized in the literature to be related to walking activity. These elements included features associated with perceived traffic safety; perceived safety from crime; traffic volume, flow or speed; and walkability. Sidewalk and bike lane presence, block length, and street width were measured to address traffic safety. Perceived safety was assessed by noting features such as the percent of houses with windows facing the street and absence of vacant lots or abandoned buildings. The presence of street trees, mixed use, public space and traffic calming measures were recorded as hypothesized livability characteristics suggested to affect walking activity. Information on each block was coded on a separate, two-page survey sheet.

Definitions of Urban Design Elements Observed

Urban Design Elements Associated with Perceptions of Traffic Safety	
Blocks with a complete sidewalk	Sidewalks present for entire block
Blocks with a complete buffered, sidewalk	Sidewalks separated from street by "buffer" (e.g., strip of lawn or landscaping)
Blocks with bike lanes	Bike lane is "marked" for entire block (e.g., by painted lines)
Blocks with bike lanes separated from the street	Bike lane is "off street" or is otherwise physically separated from car traffic for entire block
Urban Design Elements Associated with Perceived Crime Safety	
Blocks with first floor windows visible from the street	half of the buildings have first floor windows that are visible from the street
Blocks with street lighting	One or more public street lighting standards present on block
Blocks where abandoned buildings were absent	No obviously abandoned buildings on block (e.g., boarded up buildings)
Blocks where rundown buildings were absent	No buildings and/or lots with serious maintenance problems (i.e., bottom 20% of buildings—broken windows, missing porch steps, etc.)
Blocks where vacant lots were absent	No undeveloped lots that appear uncared for (e.g., accumulated trash)
Blocks where graffiti was absent	No graffiti visible. Any past graffiti painted over
Blocks where undesirable land uses were absent	No liquor stores, check cashing stores, pawn shops, bars, or adult movie or book stores
Urban Design Elements Associated with Traffic Volume, Flow or Speed	
Average number of traffic lanes within a block	Number of lanes of car traffic the road accommodates, excluding turning or parking lanes
Average street width of a block (in ft.)	Mean of street width for all blocks
Average block length of a block (in ft.)	Mean of block length for all blocks

Average sidewalk width of a block (in ft.)	Mean of sidewalk width for all blocks
Blocks with traffic circles	One or more intersections have a round-about or traffic circle that diverts traffic in a circular pattern
Blocks with bulbout	One or more intersections have a "bulb-out" or extra extension into the street to shorten travel distance for pedestrians and limit lane width for cars.
Blocks with speed bumps	Street has one or more "bumps" or other intentional elevations in the road, that are explicitly intended to slow car traffic
Blocks with cul-de-sacs	At least one end of street is closed to car traffic by a cul-de-sac or other physical closure of street
Blocks with medians	Street has one or more "islands" in the middle. Islands may or may not be landscaped, and may or may not be intended for pedestrian use
Blocks with paving treatments	One or more crosswalks is marked with a special paving (e.g., change in color or materials)
Urban Design Elements Associated with Walkability	
Blocks with street trees	Two or more trees are planted in a regular pattern in the public portion of the roadway
Blocks with mixed uses	Contains residential as well as one of the following land uses: retail/commercial, office, public, and/or industrial
Blocks with public space	Contains one or more open spaces that are not part of a private dwelling (e.g., park)
Blocks with street furniture	Contains benches, chairs, or tables for use by the public

Survey Methods

The study sample for the parent survey consisted of all parents with children in the 3rd through 5th grade attending the participating schools. Sample sizes varied across the schools, based on the number of classrooms and the number of children in each grade. Information about the number of surveys distributed at each school, and the response rate, is provided in the school-by-school summary of results later in this report.

The parent survey was designed to capture information on:

1. Parent's self-report of his or her child's travel to/from school and his or her own walking and bicycling activity in the neighborhood
2. Parent's perception of safety (crime and traffic) for his or her child while walking/bicycling to school
3. Parent's perception of the degree to which neighborhood design features influence his or her own and his or her child's walking/bicycling behavior (e.g., traffic calming treatments, traffic speed)

4. Parent's perceptions of driving behavior in the neighborhood around the school (both his or her own behavior and the behavior of others)
5. Parent's attitudes towards walking, bicycling and the trip to school
6. Parent's feelings about the social and/or cultural norms about walking, bicycling and the trip to school
7. Demographic questions about the household.

In addition, the survey asked parents to estimate the distance that they live from the schools and length of residence within their neighborhood. Such questions allow some controls for unique characteristics of the neighborhood, such as resident longevity, which may be correlated with travel behaviors. The survey was administered in English and Spanish and designed for completion in approximately 15 minutes. The survey was distributed in the classroom to be sent home and returned through the student. There was no follow-up to capture non-respondents.

In addition to these questions, a survey distributed to 3rd through 5th grade parents after SR2S construction included a battery of questions to assess parental opinion about the effectiveness of the SR2S construction project. The "after construction" survey generally included the same questions as the "before construction" survey, with two additions. The "after construction" survey included a series of questions designed to assess parents' opinions about the SR2S project. These included questions asking whether the parent noticed the project, whether he or she believed the project increased pedestrian or bicyclist safety, and how important he or she believed the construction project was. The "after construction" survey also included questions about parental walking travel, to examine whether linkages exist between parent walking or bicycling and child walking or bicycle travel that might be important for future SR2S projects. In measuring the effect of the SR2S projects, the most important survey questions include changes in the amount of walking or bicycle travel from the "before construction" and "after construction" surveys and the questions on the "after construction" survey that asked parents to assess the SR2S project. Both surveys are included as appendices in this report.

Introduction to the School-By-School Results

What follows is a summary of results for each of the nine schools. Each section below describes the results for one of the schools. In each section, the expected and measured results are presented, and then a summary discussion of the results for key outcome variables are described. Some of the expected results are indicated by a question mark in the initial discussion of expected results for each school. Expected results that are followed by a question mark are less strongly expected than are the other results noted in the table that begins each section. Each of the sections below also includes a summary of parental opinion of the SR2S project at each school and an overall assessment of the construction project at the school. For ease of readability, most percentages below are rounded to the nearest integer. The

exception is cases in which tests of statistical significance are presented. In those cases, two significant digits are used. For more detailed results, readers are referred to Volume 2 of this study.

CESAR CHAVEZ ELEMENTARY, SUMMARY OF RESULTS

Expected and Actual Results

The SR2S project at Cesar Chavez Elementary upgraded a four-way stop at the corner of Loveland and Jaboneria to a traffic light. Because a traffic light is intended to regulate yielding behavior, yielding is a key outcome indicator for this SR2S project. The traffic light might also slow vehicle speeds, which could contribute to increases in pedestrian and bicyclist safety. If the traffic light increases the sense of safety among pedestrians or bicyclists, one might expect increases in non-motorized traffic counts (pedestrian and bicycle counts). Similarly, the traffic light could reduce vehicle traffic if, for example, some cars travel alternate routes after the light is installed. These last two potential impacts—on the amount of walking/pedestrian travel and vehicle counts—are more speculative than the expected effects on yielding and vehicle speeds. Increases in walking/bicycling or decreases in vehicle counts may or may not occur given the context of a particular school neighborhood. Overall, expected impacts and the actual impacts are summarized below.

	Yielding	Vehicle speeds	Walking/ bicycling counts	Vehicle counts
Expected result	Increase	Decrease	Increase (?)	Decrease (?)
Actual result	Increase	Decrease	Increase	Increase

Note: "Actual result" is the measured outcome from study data observed after SR2S project construction.

Primary Results: Yielding and Vehicle Speeds

The table below shows the number of vehicles that yielded to pedestrians or bicyclists during the two days of observation, and the percentage of all observed vehicles that yielded. Before SR2S project construction, 95.42% of all vehicles yielded to pedestrians (584 yielded, while 28 did not). After installation of the traffic light, all vehicles observed (205 vehicles) yielded to pedestrians.

The change in the difference in the proportion of vehicles yielding, an increase of 4.58 percentage points, is statistically significant at greater than the 99% level.[2] The t-statistic for the significance of the difference between

[2] The t-test for the significance of a difference in sample proportions is

$$\frac{p1 - p2}{\sqrt{\frac{p1(100 - p1)}{n1} + \frac{p2(100 - p2)}{n2}}}$$

the yielding proportions is 3.13, suggesting that the observed difference exceeds what would be expected from random sampling variation with greater than a 99% confidence level.

Yielding of vehicles to pedestrians	Before	After
	584 (95.42%)	205 (100%)

Note: The table above shows the number of vehicles that yielded to pedestrians or bicyclists summed over morning and afternoon observation periods. Numbers in parentheses show the fraction of vehicles observed that yielded to pedestrians or bicyclists.

Percentage changes in vehicle travel speeds are shown below. The changes shown below are all negative. Travel speeds were lower after the installation of the traffic light. Yet the observed reduction exceeded the estimated human error in speed observations only for the afternoon peak period.

	A.M.		P.M.	
	Off-Peak	Peak	Off-Peak	Peak
Percentage change in vehicle speeds	-7%	-1%	-6%	-19%

Secondary Results: Walking/Bicycling

Note that one should not expect strong impacts on walking/bicycling or vehicle counts. Impacts on walking/bicycling or vehicle counts are discussed as possibly weaker effects of the installation of the traffic light. Pedestrian counts increased by 20% after the installation of the traffic light, from 1,701 pedestrians observed over the two days of before construction observation to 2,047 during the two-day after construction observation period. The survey of parents showed a reduction in the walking/bicycling mode split to school, from 51% before SR2S construction to 45.98% after the installation of the traffic light. That difference is not statistically significant (t = 1.09), however.[3]

An alternative method of inferring the SR2S project's impact on walking is to examine responses to a question in the "after construction" survey that asked parents "Think about how often your child walked or bicycled to school before the project described above was built. Would you say that your child now walks or bicycles to school: Less, The Same Amount, More." The survey responses indicated that 10 percent of parents stated that their children walked less, while 9 percent indicated that their children walked more—a slight decrease in walking travel, consistent with the observed walking counts and the walking mode split from the survey. Responses to that question varied depending on whether or not the traffic light was located along the child's route to school, as shown below. (The survey described the SR2S

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where p1 is 100%, p2 is 95.42%, n1 is 612, and n2 is 205.

[3] In the t-test, p1 = 51%, p2 = 45,89%, n1 = 251, and n2 = 207.

project and asked parents whether that project was on the child's route to school.)

	Project along child's route to school	Project not along child's route to school
Percent of children who walked more	16.09%	6.15%
Percent of children who walked less	15.94%	13.85%

Note: Percentages above are based on the number of children reported to live along and not along route to school, as opposed to the total sample as reported earlier in this section.

Among children for whom the traffic light was located along the route to school, 16.09% of those children's parents said their child walked more, compared with 6.15% of children who walked more if the SR2S project was not located along their route to school—a statistically significant difference ($t = 2.18$). Looking at the percentage of parents who said their child walked less, among children for whom the traffic light was located along the route to school, 15.94% walked to school less, compared with 13.85% who walked less among students for whom the traffic light was not located along the route to school. This difference is not statistically significant ($t = 0.41$). These figures provide evidence that, while walking might have slightly decreased or remained unchanged in the school neighborhood, walking increased for those children for whom the traffic light was located along their routes to school.

Secondary Results: Vehicle Counts

Vehicle counts generally increased, from 5% in the afternoon off-peak period to 25% in the morning off-peak period. This increase in vehicle counts is counter to expectations. Note, however, that expectations of impacts in regards to vehicle counts were weaker than the expectations regarding yielding or vehicle speeds.

	A.M.		P.M.	
	Off-Peak	Peak	Off-Peak	Peak
Percentage change in vehicle counts	+25%	+16%	+5%	+22%

Parent Perceptions

Among parents returning surveys, 85% stated that they believed that the installation of the traffic light made walking or bicycling safer, 89% stated that the project made it easier to cross the street, 83% believed that the light slowed traffic, and 76% stated that the project was either the most important project that could have been built or that it was an important project.

Overall Assessment

The installation of the traffic light was a success when gauged by the outcome indicators shown above. Yielding rates improved and vehicle speeds slowed after the light was installed. The increase in yielding rates is statistically significant. There is some evidence that walking and bicycle travel to school either remained constant or slightly decreased after the SR2S project was built. A statistically significant difference exists, however, between two groups of children, those for whom the light was on their route to school versus those for whom the light was not on their route to school. Among children who passed the light, more of an increase in walking was noted, compared with children who would not pass the light on their way to school. This difference is statistically significant. Parent surveys indicate a high degree of satisfaction with the project.

GLENOAKS ELEMENTARY, SUMMARY OF RESULTS

Expected and Actual Results

At Glenoaks Elementary, SR2S funds supported installing a pedestrian-activated, in-pavement flashing warning light system at a crosswalk in front of the school on Glenoaks Boulevard. In general terms, the research team expected projects of this type to improve the yielding of vehicles to pedestrians and to reduce vehicle speeds. At Glenoaks Elementary, traffic is heavily congested in front of the school during morning drop-off and afternoon pickup times. Average vehicle speeds on Glenoaks Boulevard before construction of the SR2S project were 12 miles per hour during the morning peak and 15 miles per hour in the afternoon peak. Further slowing of vehicle speeds might be unlikely, due to the pre-existing congestion at the project location. It is also possible that the project could induce more walking or bicycling travel, although this would be a secondary impact resulting from improvements in safety that might encourage more non-motorized travel to or from school. The project's expected and measured effects are outlined below.

	Yielding	Vehicle speeds	Walking/bicycling counts
Expected result	Increase	Decrease	Increase (?)
Actual result	Increase	None	Increase

Note: "Actual result" is the measured outcome from study data observed after SR2S project construction.

Primary Results: Yielding and Vehicle Speeds

Before installment of the in-pavement crosswalk lighting system, 225 vehicles were observed to yield to non-motorized traffic, while 14 did not yield—a "before construction" yield rate of 94.14%. After installing the crosswalk lighting system, the observed yield rate increased to 97.71%—128 out of 131 vehicles observed yielded. This increase in yielding rates is statistically significant at the 10% level (t-statistic = 1.67).

Yielding of vehicles to pedestrians	Before	After
	225 (94.14%)	128 (97.71%)

Note: The table above shows the number of vehicles that yielded to pedestrians or bicyclists summed over morning and afternoon observation periods. Numbers in parentheses show the fraction of vehicles observed that yielded to pedestrians or bicyclists.

Changes in vehicle travel speeds on Glenoaks Boulevard are outlined below. Those changes reveal the percentage increase or decrease in the "before construction" speed compared with the "after construction" speed. None of the changes below are outside of the human error range of +/- 0.3 seconds

in stopwatch start and stop times. The research team concluded that vehicle speeds did not change.

	A.M.		P.M.	
	Off-peak	Peak	Off-peak	Peak
Percentage Change in Vehicle Speeds	-4%	+11%	+5%	+12%

Secondary Results: Walking/Bicycling

The total number of observed pedestrians and bicyclists was 148 during the two days of "before construction" observations and 974 during the two days of "after construction" observations, an increase of 558%. This is a substantial increase, and is large enough that one might question whether the observation techniques yield accurate counts. The research team also examined corroborating information from the survey, and concluded that non-motorized travel did in fact increase at Glenoaks Elementary after the crosswalk lighting system was installed.

The survey results give walking/bicycling mode splits (for the trip to school) of 14.83% before SR2S project construction and 9.86% after the project. This difference is not statistically significant (t-statistic = 1.4). More importantly, the survey results showed that more "before construction" survey respondents lived close to the school, while fewer "after construction" respondents lived near the school. In the "before construction" survey, 42% of respondents reported that the lived within a quarter-mile of the school, and 81% of respondents said they lived within a half-mile of the school. In the "after construction" survey, only 11% of respondents stated that they lived with a quarter-mile of the school, and 32% of the respondents said they lived with a half-mile of the school. This shift toward residents who lived further from the school should reduce reported walking/bicycling mode splits. Across all schools, walking and bicycling is most common among children who live within a half-mile from their school. Given the change in the distance from school across the two surveys, it is surprising that walking/bicycling mode splits did not drop more from the "before construction" to "after construction" survey. The lack of a larger drop in reported walking and bicycling is consistent with the observed increase in pedestrian and bicycle counts.

An alternative method of inferring the SR2S project's impact on walking is to look at responses to a question in the "after construction" survey that asked parents "Think about how often your child walked or bicycled to school before the project described above was built. Would you say that your child now walks or bicycles to school: Less, The Same Amount, More."

	Project along child's route to school	Project not along child's route to school
Percent children walked more	10.71%	6.25%
Percent children walked less	7.14%	16.25%

Among children for whom the lighted crosswalk was along the route to school, 10.71% of those children's parents said their child walked more, compared with 6.25% of children who walked more if the SR2S project was not along their route to school. This difference, 4.46 percentage points, is not statistically significant (t-statistic = 0.90). Looking at the percentage of parents who said their child walked less, among children for whom the lighted crosswalk was along the route to school, 7.14% walked to school less, compared with 16.25% who walked less among students for whom the crosswalk was not along the route to school. This difference, 9.11 percentage points, is statistically significant at the 10 percent level (t-statistic = 1.70). The largest fraction of parents reported no change in their children's walking behavior. This finding can be interpreted as being weakly consistent with the observed increases in pedestrian and bicycle counts. Reductions in walking/bicycling travel were smaller for children whose path to school passed the crosswalk. Overall, the research team believes that the survey does not more strongly corroborate that observation because of the change toward a sample of children who lived more distant from school in the "after construction" survey responses. Yet the research team also notes that the evidence, taken as a whole, suggests an increase in walking and bicycling travel to school after the SR2S project was built.

Parent Perceptions

Among parents surveyed after the lighted crosswalk system was installed, 78% replied that they believed the project made walking/bicycling safer, 84% stated that the project made it easier to cross the street, and 84% believed that the lighted crosswalk made drivers more aware of children. Among survey respondents, 19% stated that the lighted crosswalk was the most important pedestrian/bicyclist safety project that could have been built near Glenoaks Elementary, while another 51% described the crosswalk as an important project.

Overall Assessment

The lighted crosswalk was a success. Yielding rates improved. While vehicle speeds did not change, vehicle speeds were slow before the SR2S project was built due to high congestion levels during the morning drop-off and afternoon pickup periods at Glenoaks Elementary. The evidence also suggests an increase in walking and bicycling among students at Glenoaks Elementary, although the interpretation of this evidence is complicated by the fact that respondents to the "after construction" survey lived farther from school than did "before construction" survey respondents.

JASPER ELEMENTARY, SUMMARY OF RESULTS

Expected and Actual Results

For Jasper Elementary, SR2S funds supported installing a pedestrian-activated, in-pavement flashing warning light system at a crosswalk on 19th Street at Jasper Street. This improvement is located about a quarter mile north of the school. The research team expected projects of this type to improve the yielding of vehicles to pedestrians, to reduce vehicle speeds, and to increase walking. After pre-construction data collection and before the post-construction data collection, the nearby extension of Interstate 210 was completed and opened to traffic. This highway is located parallel to 19th Street and approximately 1000 feet north. The opening of the extension of Interstate 210 project should be expected to decrease vehicle volumes on 19th Street, which might also increase vehicle speeds—an impact that might counteract the expected effect of the SR2S project on vehicle speeds.

Yielding was already very high at this location (27 of 28 vehicles). Although it improved to 100% post-construction, the difference was not significant. The number of child pedestrians and bicyclists was rather low and no conclusions can be drawn from the modest increase after construction of the SR2S project. Vehicle speed increased, but this change is probably attributable to the completion of the nearby freeway. Thus, although changes in yielding and walking/bicycling counts were in the expected direction, these changes are not large enough to permit a conclusion that the SR2S project increased the safety of non-motorized transportation at this location. The expected effects of the SR2S project and of the I-210 extension are shown below with the measured effect.

	Yielding	Vehicle speeds	Walking/bicycling counts
Expected effect of SR2S project	Increase	Decrease	Increase
Expected effect of 210 extension	None	Increase	None
Actual result	None	Increase	None

Note: "Actual result" is the measured outcome from study data observed after SR2S project construction.

Primary Results: Yielding and Vehicle Speeds

Before installment of the in-pavement crosswalk lighting system, 28 vehicles were observed to yield to non-motorized traffic, while 1 did not yield—a "before construction" yield rate of 96.43%. After installing the crosswalk lighting system, the observed yield rate increased to 100%—30 of 30 vehicles observed yielded. This increase in yielding rates is not statistically significant (t-statistic = 1.04).

Yielding of vehicles to pedestrians	Before	After
	28 (96.43%)	30 (100%)

Note: The table above shows the number of vehicles that yielded to pedestrians or bicyclists summed over morning and afternoon observation periods. Numbers in parentheses show the fraction of vehicles observed that yielded to pedestrians or bicyclists.

Changes in vehicle travel speeds on 19th Street are shown below. Those changes are the percentage increase or decrease in the "before construction" speed compared with the "after construction" speed. The increase in the off-peak a.m. speed is outside of the human error range of +/- 0.3 seconds in stopwatch start and stop times, and the other changes are in the same direction. The research team therefore concludes that there was an increase in speed at this location.

	A.M.		P.M.	
	Off-peak	Peak	Off-peak	Peak
Percentage change in vehicle speeds	+23%	+11%	+14%	+12%

Primary Results: Walking and Bicycling

The total number of observed pedestrians and bicyclists was 51 during the two days of "before construction" observations and 57 during the two days of "after construction" observations, an increase of 6 students or 12%. This increase in too small, both in absolute and relative terms, to conclude that the SR2S project increased walking.

The survey results give walking/bicycling mode splits (for the trip to school) of 18.18% before SR2S project construction and 14.29% after the project. This difference is not statistically significant (t-statistic = 0.76).

On the "after construction" survey, parents were also asked to compare the frequency of their child's walking currently to the frequency before the SR2S project was constructed. Only one child (2.33%) walked more. The SR2S project was located along this child's route to school. Three children (6.98%) whose route to school included the project and four children (12.90%) whose route to school did not include the project walked less after the project. Neither of these changes differed significantly by whether the project was along the child's route to school (t=1.01 and 0.83 respectively).

	Project along child's route to school	Project not along child's route to school
Percent children walked more	2.33%	0.00%
Percent children walked less	6.98%	12.90%

Overall, the survey, like the counts of child pedestrians and bicyclists, showed only slight increases in walking and bicycling travel to school along the route that included SR2S project.

Parent Perceptions

Among parents surveyed after the lighted crosswalk system was installed, 64% replied that they believed the project made walking/bicycling safer, 66% stated that the project made it easier to cross the street, and 62% believed that the lighted crosswalk made drivers more aware of children. Among survey respondents, 23% stated that the lighted crosswalk was the most important pedestrian/bicyclist safety project that could have been built near Jasper Elementary School, while another 44% described the crosswalk as an important project.

Overall Assessment

Yielding rates, children observed walking or cycling to school, and the reported changes in walking among children whose route to school included the project all improved slightly after the SR2S project was completed. A majority of parents believed that the project was beneficial and important. Findings are inconclusive as to whether this project actually improved the safety of crossing 19th Street at this location.

JUAN CABRILLO ELEMENTARY, SUMMARY OF RESULTS

Expected and Actual Results

At Juan Cabrillo Elementary, SR2S funds supported the design and construction of a pathway of decomposed granite, bordered by an 8-inch wood curb, with appropriate signage, along Morning View Drive from Seastar Drive to Via Cabrillo. Because the path was intended to regulate walking and bicycling behavior, the total number of child pedestrians and the number of pedestrians walking on a path rather than on the street or shoulder are key outcome measures for this SR2S project. The expected impacts and the actual impacts are summarized below.

	Walking/bicycling counts	Child pedestrian locations
Expected result	Increase	Increase in amount of walking on sidewalk
Actual result	Evidence of both increase and no change	Increase in amount of walking on sidewalk

Note: "Actual result" is the measured outcome from study data taken after SR2S project construction.

Primary Results: Walking/Bicycling and Location of Walking

The table below shows the amount of walking and bicycling by children on their way to school as reported by parents in the survey. Before SR2S project construction, 5.17% of all children traveling to school walked or bicycled (3 out of 58 children). After installation of the path, 7.89% of children walked or bicycled to school (3 out of 38 children).

The change in the difference in the amount of walking or bicycling, an increase of 2.72 percentage points, is not statistically significant.[4] The t-statistic for the significance of the difference between the amount of walking and bicycling proportions is 0.52, suggesting that the observed difference does not exceed what would be expected from random sampling variation.

Amount of walking and bicycling	Before	After
	3 (5.17%)	3 (7.89%)

Note: The table above shows the number of children who walked or bicycled to school as reported by parents.

[4] The t-test for the significance of a difference in sample proportions is

$$\frac{p1 - p2}{\sqrt{\frac{p1(100 - p1)}{n1} + \frac{p2(100 - p2)}{n2}}}$$

where p1 is 7.89%, p2 is 5.17%, n1 is 38, and n2 is 58.

The number of total child pedestrians is shown below. As this table reveals, the total number of child pedestrians increased by 10% after the SR2S project was completed (from 274 child pedestrians to 302).

	Before	After	% Change
Total child pedestrians	274	302	+10%

The observations of pedestrians in front of Juan Cabrillo Elementary School included an assessment of the number of children walking on the street or shoulder, as well as those walking on a sidewalk or path. The percentage of child pedestrians using a sidewalk or path, versus a shoulder or street, is shown below. The change in the difference in the number of children using a shoulder or street, a decrease of 4.58 percentage points, is statistically significant at greater than the 99% level.[5] The t-statistic for the significance of the difference between child pedestrians using a shoulder or street is -2.69, suggesting that the observed difference exceeds what would be expected from random sampling variation with greater than a 99% confidence level.

Child pedestrian locations	Before	After
Sidewalk or path only	256 (93.43%)	296 (98.01%)
Shoulder or street	18 (6.57%)	6 (1.99%)

While walking mode splits from the survey were relatively low at Juan Cabrillo Elementary, walk counts (i.e., number of children observed walking) were high. The research team observed that many parents who drive their children to Juan Cabrillo Elementary park on a narrow road some distance from the school, and then walk the child into school. Hence observed walking travel directly in front of the school is higher than what one would expect based on the reported mode of travel to school.

Parent Perceptions

Among parents returning surveys, 86.84% stated that they believed the creation of the path made walking or bicycling safer, 81.58% stated that the project helped separate children from cars, and 63.16% stated that the project was either the most important project that could have been built near the school or that it was an important project.

[5] The t-test for the significance of a difference in sample proportions is

$$\frac{p1 - p2}{\sqrt{\frac{p1(100 - p1)}{n1} + \frac{p2(100 - p2)}{n2}}}$$

where p1 is 1.99%, p2 is 6.57%, n1 is 302, and n2 is 274.

Overall Assessment

The installation of the path was a moderate success when gauged by the outcome indicators shown above. The observed number of child pedestrians increased by 10%, but the mode split reported from survey data suggest no statistically significant change in the proportion of children who walk or bicycle to school. The research team concludes that it is not possible to reconcile these conflicting pieces of evidence, and so we note that one could conclude that there was either a small increase in walking or no change in the amount of walking. The proportion of children walking on a street or shoulder decreased, and the reduction is statistically significant. This result suggests that the creation of the path gave child pedestrians more options that did not involve direct contact with vehicles when walking to school than existed before construction of the SR2S project. The parent surveys indicate a high degree of satisfaction with the project. Overall, the project likely contributed to safety by increasing the separation of child pedestrians from traffic, but one should note that little walking travel near Juan Cabrillo was on the street or shoulder before the SR2S project was built.

MT. VERNON ELEMENTARY, SUMMARY OF RESULTS

Expected and Actual Results

At Mt. Vernon Elementary, the SR2S program supported the installation of pedestrian activated signals at the intersections of 9th Street and Mt. Vernon and 9th and "L" Streets. Both of these intersections had traffic signals before the SR2S project, but no pedestrian warning lights. The new pedestrian-activated signals include a countdown device to warn pedestrians how much time remains before the light changes. This project did not fit well into the typology of measured results. The research team expected to find little or no impact from a pedestrian signal on vehicle counts, speeds, or yielding, given that the intersections already had traffic lights. Similarly, it seems unlikely that the project would induce a change in the location of pedestrians—i.e. a shift on or off of existing sidewalks. The only expected impact is an increase in the amount of walking travel. The expected and measured effect of the pedestrian-activated signal is shown below.

	Walking/bicycling counts
Expected result	Increase (?)
Actual result	None

Note: "Actual result" is the measured outcome from study data taken after SR2S project construction.

Primary Result: Walking/Bicycling

The total number of observed pedestrians was 193 during the two days of "before construction" observations and 137 during the two days of "after construction" observations, a decrease of 29%. The survey results give walking/bicycling mode splits for the trip to school of 41.90% before SR2S project construction and 44.20% after the project. This difference is not statistically significant (t-statistic = 0.41).

An alternative method of inferring the SR2S project's impact on walking is to examine responses to a question in the "after construction" survey that asked parents "Think about how often your child walked or bicycled to school before the project described above was built. Would you say that your child now walks or bicycles to school: Less, The Same Amount, More." The results suggest a decrease in walking activity after the SR2S project was completed—19 parents stated that their child walked less, while 10 parents said their child walked more. This finding is consistent with the drop in the number of pedestrians from the observation of walking and bicycling travel. Differences were identified in the responses to the question about changes in child walking behavior depending on whether or not the pedestrian signals were along the child's walk to school.

	Project along child's route to school	Project not along child's route to school
Percent children walked more	11.76%	3.28%
Percent children walked less	16.18%	13.12%

Among children for whom the pedestrian signals were located along their route to school, 11.76% of those children's parents said their children walked more, compared with 3.28% of children who walked more if the SR2S project was not located along their route to school. This difference, 8.38 percentage points, is statistically significant at the 10% level (t-statistic = 1.86). Looking at the percentage of parents who said their children walked less, among children for whom the pedestrian signals were along the route to school, 16.18% walked to school less, compared with 13.12% who walked less among students for whom the pedestrian signals were not along their route to school. This difference, 3.06 percentage points, is not statistically significant (t-statistic = 0.49). These results are consistent with an overall decline in walking or bicycling travel, but suggest that the decline was less pronounced among children who would pass the pedestrian signals in their travel to school.

The observations and survey data were collected on September 30 and October 2, 2002 ("before construction" data collection) and July 15 and July 17, 2003 ("after construction" data collection). It is possible that warmer weather in July may have reduced non-motorized walking travel. While in general the research team attempted to collect "before construction" and "after construction" data at similar times of the year, that was not always possible given the difficulty of coordinating school schedules with the need to complete the SR2S evaluation by the end of 2004.

Parent Perceptions

Among parents surveyed after the pedestrian signals were installed, 71% replied that they believed the project made walking/bicycling safer and 75% stated that the project made it easier to cross the street. Among survey respondents, 23% stated that the lighted crosswalk was the most important pedestrian/bicyclist safety project that could have been built near Mt. Vernon School, while another 37% described the crosswalk as an important project.

Overall Assessment

While parent perceptions of this project are favorable, parents perceived all of the SR2S projects studied in this research in a favorable light. The project at Mt. Vernon Elementary produced little measurable impact on walking or bicycling travel, and the impacts that exist in some cases suggest less walking rather than more. On the other hand, installing pedestrian signals near intersections that already have traffic lights might not produce effects that would be captured by this study. One could conjecture that the effect of the SR2S project near Mt. Vernon Elementary would be to increase the

convenience of walking or bicycling to school and to remove children from the path of car travel, with impacts on safety that may not be well measured by the outcome variables used in this study. Overall, the research team concludes that this study gives little evidence of objective measures of the impact of the SR2S project at Mt. Vernon Elementary, but parents think highly of the project nevertheless.

MURRIETA ELEMENTARY, SUMMARY OF RESULTS

Expected and Actual Results

The SR2S project at Murrieta Elementary involved a series of new sidewalks, sidewalk gap closures, and on-street bicycle paths along portions of Adams Avenue, "B" Street, 2nd Avenue, and Kalmia Street near the school. One would expect this project to increase the amount of walking and bicycling activity and to increase the amount of walking that occurs on the sidewalk as opposed to on the street or shoulder. No impact on traffic was expected.

	Walking/bicycling counts	Location of walking
Expected result	Increase	Increase in amount of walking on the sidewalk
Actual result	Increase	None

Note: "Actual result" is the measured outcome from study data taken after SR2S project construction.

Primary Results: Walking/Bicycling and Location of Walking

Observed child pedestrian travel increased from 2 pedestrians before construction (summed over both days of observation) to 19 pedestrians after construction. While this is an 850% increase in the amount of child pedestrian activity, this increase is on an exceptionally small base. The more striking finding is the small amount of walking near Murrieta Elementary School both before and after the sidewalk/bicycle path project.

Of the observed child pedestrians, only 1 child walked on the street or shoulder, and this was after the SR2S project had been built. The research team concluded that the base of walkers was too small to draw meaningful inferences about the impact of the SR2S project in encouraging persons to walk on the sidewalk as opposed to on the street or shoulder.

The survey results give walking/bicycling mode splits for the trip to school of 5.38% before SR2S project construction and 6.40% after the project. This difference is not statistically significant (t-statistic = 0.38).

An alternative method of inferring the SR2S project's impact on walking is to examine responses to a question in the "after construction" survey that asked parents "Think about how often your child walked or bicycled to school before the project described above was built. Would you say that your child now walks or bicycles to school: Less, The Same Amount, More."

	Project along child's route to school	Project not along child's route to school
Percent children walked more	9.68%	1.67%
Percent children walked less	14.52%	0%

Among children for whom the sidewalks or bicycle paths were located along the route to school, 9.68% of those children's parents said their children walked more, compared with 1.67% of children who walked more if the SR2S project was not along their route to school. This difference, 8.01 percentage points, is statistically significant at the 5% level (t-statistic = 2.0). Looking at the percentage of parents who said their child walked less, among children for whom the SR2S project was along the route to school, 14.52% walked to school less, compared with 0% who walked less among students for whom the SR2S project was not along the route to school. This difference, 14.52 percentage points, is statistically significant at the 1% level (t-statistic = 3.24). Overall, these results are inconclusive, as children who passed along the sidewalk/bicycle path project on their way to school reported both more walking and (oddly) less walking compared to children who did not pass the project. Note that Murrieta Elementary is unusual in that the sidewalk projects are located on all sides of the school, implying that many students would pass a portion of the project. This fact might weaken the ability to distinguish the effect of the SR2S project by comparing students who would and would not pass the project in the case of Murrieta Elementary.

Parent Perceptions

Among parents surveyed after the SR2S project was built, 85% replied that they believed the project made walking/bicycling safer and 72% stated that the project separated children from cars. Among survey respondents, 15% stated that the sidewalks and bicycle paths were the most important pedestrian/bicyclist safety project that could have been built near Murrieta Elementary, while another 60% described the sidewalks and bicycles paths as an important project.

Overall Assessment

The data give weak evidence that the sidewalk/bicycle path project induce more walking. Pedestrian counts increased, but the levels both before and after SR2S project construction were so low that the magnitude of the increase is small. Possibly because the magnitude is small, the increase in non-motorized travel cannot be corroborated with the survey data. Yet parents have a favorable opinion of the project. Overall, the results suggest that in neighborhoods with very low walking travel, construction of sidewalks and bicycle paths might not be sufficient to induce large increases in walking to school. Instead, such neighborhoods may require multiple interventions, including construction projects and education or public awareness campaigns targeted at children or parents.

SHELDON ELEMENTARY, SUMMARY OF RESULTS

Expected and Actual Results

The SR2S project at Sheldon Elementary School closed gaps in the sidewalk along San Pablo Dam Road. Before the SR2S project, only 100-feet of sidewalk existed along an approximate 500-foot stretch of San Pablo Dam Road near the school. The SR2S funds supported completion of the sidewalk network along both sides of this portion of road. This project is expected to encourage more children to walk on the sidewalk, as opposed to on the street or shoulder. An increase in the amount of walking travel due to the improved pedestrian environment is also expected. No impact on vehicle traffic is expected as a result of the SR2S project.

	Walking/bicycling counts	Location of walking
Expected result	Increase	Increase in amount of walking on sidewalk
Actual result	Increase	Increase in amount of walking on sidewalk

Note: "Actual result" is the measured outcome from study data taken after SR2S project construction.

Primary Results: Walking/Bicycling and Location of Walking

Observed child pedestrian travel increased 10% after the sidewalk construction, from 138 child pedestrians before construction (summed over both days of observation) to 152 pedestrians after construction.

Of the observed child pedestrians, 66% walked on a path or shoulder at some point during the "before construction" observations. Many of those children walked along the sidewalk where it existed but then moved onto the street or shoulder where the sidewalk ended or had gaps. After the construction of a more complete sidewalk network along San Pablo Dam Road, only 35% of the child pedestrians were observed walking on the street or shoulder.

	Before SR2S construction	After SR2S construction
Child pedestrians on sidewalk only	47 (34%)	99 (65%)
Child pedestrians on street or shoulder	91 (66%)	53 (35%)

Note: The table above shows the number of observed children and, in parentheses, the percentage of children in the category as a percentage of total observed child pedestrians in the "before construction" or "after construction" periods.

This shift of child pedestrians onto a sidewalk could be an important safety improvement. San Pablo Dam Road is a busy street. Measured vehicle travel speeds on that road, when averaged over 10-minute intervals, ranged between 30 and 40 miles per hour. Since these are 10-minute average speeds, some cars were traveling faster. Thus, the separation of children from vehicle traffic, which the SR2S project appears to have improved, is an important safety improvement at this location.

The survey results give walking/bicycling mode splits for the trip to school of 11.27% before SR2S project construction and 5% after the project. This difference is not statistically significant (t-statistic = 1.41).

An alternative method of inferring the SR2S project's impact on walking is to examine responses to a question in the "after construction" survey that asked parents "Think about how often your child walked or bicycled to school before the project described above was built. Would you say that your child now walks or bicycles to school: Less, The Same Amount, More." Among survey respondents, 5 parents stated that their children walked to school more, 24 stated that their children walked to school less, and 28 said their children walked to school the same amount when compared with a year ago. These replies are not consistent with the observed increases in walking travel along San Pablo Dam Road. To infer the impact of the sidewalk improvement project, the research team analyzed the replies to this question by separating children into two groups: those who would walk past the SR2S project and those whose trip to school would not take them past the project. (The survey included a question that asked parents whether their children would walk past the SR2S project on the way to school.)

Among children for whom the new sidewalks were located along the route to school, 11.11% of those children's parents said their child walked more, compared with no children who walked more if the SR2S project was not located along their route to school. This difference, 11.11 percentage points, is statistically significant at the 5% level (t-statistic = 2.36). Looking at the percentage of parents who said their child walked less, among children for whom the new sidewalks were located along the route to school, 35.56% walked to school less, compared with 25% who walked less among students for whom the sidewalk was not located along the route to school. This difference, 11 percentage points, is not statistically significant (t-statistic = 1.05).[6]

[6] While the percentage point difference is almost the same across the two samples for children who walked more and less (close to 11 percentage points in both cases), this difference is only statistically significant in the case of the children who walked more. This is because the standard error used to compute the t-test becomes larger as the sample percentages approach 50%, and the sample percentages for "walked less" are closer to 50% than are the sample percentages for "walked more."

	Project along child's route to school	Project not along child's route to school
Percent of children who walked more	11.11%	0%
Percent of children who walked less	35.56%	25%

Overall, these results provide some evidence that the sidewalk project induced an increase in walking for the students would travel along San Pablo Dam Road on their way to school, even if the mode splits for the entire survey sample do not show a statistically significant increase in walking.

Parent Perceptions

Among parents surveyed after the SR2S project was built, 84% replied that they believed the project made walking/bicycling safer and 75% stated that the project separated children from cars. Among survey respondents, 34% stated that the sidewalks and bicycle paths were the most important pedestrian/bicyclist safety project that could have been built near Sheldon Elementary, while another 44% described the sidewalks and bicycles paths as an important project.

Overall Assessment

The data show that the sidewalk improvements near Sheldon Elementary School separated child pedestrians from fast-moving vehicle traffic. The shift of observed child pedestrians from the street or shoulder onto the sidewalk was large both in percentage terms and in magnitude. The survey gives no evidence of increases in waking to school. When the sample is split depending on whether or not a child would walk past the new sidewalks, however, some evidence exists that children who would pass the sidewalk on their way to school had more increases in walking than did other children. Parent perceptions of the project are strongly positive. Overall, both the objective data and the perceptions of parents suggest that the SR2S project near Sheldon Elementary was a success. The project is expected to have improved the safety of children walking to or from that school.

VALLEY ELEMENTARY, SUMMARY OF RESULTS

Expected and Actual Results

The SR2S project at Valley Elementary, consisting of sidewalk and pedestrian crossing improvements, links the existing sidewalk at five separate points along both Avenue "E" and 8th Street. Over 3000 feet of sidewalk, curb, gutter and drainage were installed, as well a curb ramp, a crosswalk and four crosswalk signs.

Because the sidewalk and pedestrian crossing improvements were intended to increase walking and bicycling behavior, both the amount child walking and bicycling and the fraction of total walking that is on the sidewalk are key outcomes for this SR2S project. The yielding behavior of vehicles is another factor that may be enhanced by pedestrian crossing improvements. The crosswalk might also slow vehicle speeds, which could contribute to increases in pedestrian and bicyclist safety. The potential impact of the project on reducing vehicle speeds is more speculative than the other expected results, and so is evaluated as a secondary impact. Overall, expected results and actual results for Valley Elementary School are summarized below.

	Walking/bicycling counts	Child pedestrian locations	Yielding	Vehicle speeds
Expected result	Increase	Increase in amount of walking on sidewalk	Increase in yielding to pedestrians	Decrease (?)
Actual result	Increase	Increase in amount of walking on sidewalk	None	None

Note: "Actual Result" is the measured outcome from study data recorded after SR2S project construction.

Primary Results: Walking/Bicycling and Location of Walking

The number of total child pedestrians observed before and after the construction of the sidewalk and crosswalk is shown below. The total number of child pedestrians observed at the location of the crosswalk decreased by 6% after the SR2S project was completed (from 95 child pedestrians to 89).

	Before	After	% Change
Total child pedestrians	95	89	-6.00%

Note that rainfall on one of the days of "after construction" observations could have reduced the child pedestrian counts and thus might mask

increases in walking that would have been otherwise observed. (See also the discussion, below, of survey data on parents' reports of children's models for travel to school on typical day.)

The percentage of child pedestrians using a sidewalk or path, as opposed to a shoulder or street, is shown below. Before construction of the new sidewalks and crosswalk, 42.10% of the child pedestrians observed used a street or shoulder on at least a portion of their route. After construction of the SR2S project, only 4.49% of child pedestrians observed use a street or shoulder. The change in the difference in the number of children using a shoulder or street, a decrease of 37.61 percentage points, is statistically significant at greater than the 99% level.[7] The t-statistic for the significance of the difference between child pedestrians using a shoulder or street is –6.81, suggesting that the observed difference exceeds what would be expected from random sampling variation with greater than a 99% confidence level.

Child pedestrian locations	Before	After
Sidewalk or path only	55 (57.90%)	85 (95.51%)
Shoulder or street	40 (42.10%)	4 (4.49%)

The table below shows the amount of walking and bicycling by children on their way to school as reported by parents in the survey. Before SR2S project construction, 8.28% of the survey respondents stated that their children walked or bicycled to school (13 out of 157 children). After installation of the new sidewalk and crosswalk, only 6.40% of respondents reported that their children walked or bicycled to school (8 out of 125 children). This change, a decrease of 1.88 percentage points, is not statistically significant.[8] The t-statistic for the significance of the difference between the amount of walking and bicycling proportions is -0.60, suggesting that the observed difference does not exceed what would be expected from random sampling variation.

Amount of walking and bicycling	Before	After
	13 (8.28%)	8 (6.40%)

Note: This table shows the number of children who walked or bicycled to school as reported by parents.

[7] The t-test for the significance of a difference in sample proportions is

$$\frac{p1 - p2}{\sqrt{\frac{p1(100 - p1)}{n1} + \frac{p2(100 - p2)}{n2}}}$$

where p1 is 4.49%, p2 is 42.10%, n1 is 89, and n2 is 95.

[8] The t-test for the significance of a difference in sample proportions is

$$\frac{p1 - p2}{\sqrt{\frac{p1(100 - p1)}{n1} + \frac{p2(100 - p2)}{n2}}}$$

where p1 is 6.40%, p2 is 8.28%, n1 is 125, and n2 is 157.

An alternative method of inferring the SR2S project's impact on walking is to examine responses to a question in the "after construction" survey that asked parents, "Think about how often your child walked or bicycled to school before the project described above was built. Would you say that your child now walks or bicycles to school: Less, The Same Amount, More." Among survey respondents, 8 parents stated that their child walked to school more, 12 stated that their child walked to school less, and 70 said their child walked to school the same amount, when compared with a year ago. To infer the impact of the sidewalk improvement project, responses to this question were analyzed by separating children into two groups—those who would walk past the SR2S project and those whose trip to school would not take them past the project. (The survey included a question asking parents whether their children would walk past the SR2S project on the way to school.)

Among children for whom the new sidewalk was along the route to school, 11.42% were described by their parents as walking more after the SR2S project. In contrast, among those for whom the new sidewalk was not along the route to school, no children were described as walking more after the SR2S project. This difference, 11.42 percentage points, is statistically significant at the 1% level (t-statistic = 3.01). Among children for whom the new sidewalks were along the route to school, 11.42% walked to school less often after the SR2S project. In comparison, among those for whom the new sidewalks and crosswalk were not along the route to school, 20% of children walked to school less often after the SR2S project. This difference, 8.58 percentage points, is not statistically significant (t-statistic = 0.88).

	Project along child's route to school	Project not along child's route to school
Percent of children who walked more	11.42%	0%
Percent of children who walked less	11.42%	20%

The results in the above table are consistent with no overall change in walking or bicycling to school, or even a slight reduction in total walking/bicycling travel. Aggregate counts might mask increases in walking/bicycling travel for children who pass the new sidewalk or crosswalk, however, which could counter-balance decreases in walking or bicycling for children who live elsewhere in the neighborhood.

Primary Results: Yielding

Before sidewalk and pedestrian crossing improvements were installed, 18 vehicles were observed to yield to non-motorized traffic, while 1 did not yield—a "before construction" yield rate of 95.00%. After installing the SR2S project, the observed yield rate increased to 100%, or 12 out of 12 vehicles observed yielded. This increase in yielding rates is not statistically significant (t-statistic = 1).

Yielding of vehicles to pedestrians	Before	After
	18 (95.00%)	12 (100.00%)

Note: The table above shows the number of vehicles that yielded to pedestrians or bicyclists summed over morning and afternoon observation periods. The number in parentheses shows the fraction of vehicles observed that yielded to pedestrians or bicyclists.

Secondary Result: Vehicle Speeds

Changes in vehicle travel speeds on 8th Street are shown below. These changes are the percentage increase or decrease in the "before construction" speed compared with the "after construction" speed. Only changes in vehicle speeds for the morning observation period are reported. On one of the two days of "after construction" observations, rainfall interfered with traffic observations. For that reason, vehicle speeds are not shown, as the research team did not have an opportunity to obtain a consistent set of "before construction" and "after construction" speed data at Valley Elementary School.

All measured vehicle speeds increased after SR2S construction, but the observed increase did not exceed the estimated human error in speed observations. No measured change in vehicle speeds can be identified.

	A.M.	
	Off-peak	Peak
Percentage change in vehicle speeds	+6.40%	+11.00%

Parent Perceptions

The new sidewalks and crosswalks were perceived as positive improvements among parents of children at Valley Elementary. Among parents returning surveys, 79% stated that the construction of the sidewalk and crosswalk made it easier to cross the street, 77% stated that they believed the SR2S project made walking or bicycling safer, and 66% stated that the sidewalk and crosswalk helped separate children from cars. Among survey respondents, 78% stated that the project was either the most important project that could have been built or that it was an important project.

Overall Assessment

The installation of the sidewalk and crosswalk had no measured effect on vehicle speeds or yielding of vehicles to pedestrians. It is questionable whether the project should have slowed car traffic, and there were few opportunities to observe a change in yielding, contributing to the statistically insignificant change in yielding rates.

More positively, the percentage of child pedestrians using a shoulder or street when traveling to and from school decreased substantially after

construction, suggesting that the project helped separate non-motorized traffic from vehicles. The observed pedestrian counts do not show an increase in the amount of walking, and walking/bicycling mode splits from the survey give no statistically significant change. Yet the survey does suggest that even if the amount of walking or bicycling among school children in the neighborhood did not change, that aggregate effect might include increases in walking or bicycling for children who would use the sidewalk and decreases in walking or bicycling for children who would not pass the sidewalk on the way to school.

Parents have a strongly positive opinion of the sidewalk and crosswalk project. Overall, the measured results give evidence that the sidewalk and crosswalk separated children from street traffic and may have induced some additional walking travel. This suggests that the SR2S project at Valley Elementary School was a success.

WEST RANDALL ELEMENTARY SCHOOL, SUMMARY OF RESULTS

Expected and Actual Results

The SR2S program supported the construction of approximately 2,200-feet of sidewalk along Randall Avenue, from Marcona to Poplar Avenues, in front of West Randall Elementary School. Previously, much of the shoulder of Randall Avenue around the school was dirt and, therefore prone to dust and mud, which could encourage walking in the street rather than on the shoulder. The research team expected that this project would increase the amount of walking on the sidewalk, diverting pedestrian activity off of the shoulder of the road and the street. Increases in the amount of walking were also expected. The expected and actual results are shown below.

	Walking/bicycling counts	Location of walking
Expected result	Increase	Increase in amount of sidewalk
Actual result	Increase	Increase in amount of sidewalk

Note: "Actual result" is the measured outcome from study data taken after SR2S project construction.

Primary Results: Walking/Bicycling and Location of Walking

Observed child pedestrian travel increased 66% after the sidewalk construction, from 692 child pedestrians before construction (summed over both days of observation) to 1,146 pedestrians after construction.

Of the observed child pedestrians, 75% walked on a path or shoulder at some point during the "before construction" observations. Children who walked along a sidewalk and then walked in the shoulder for a short time were classified as walking on the street or shoulder. Conversely, the counts of children walking on the sidewalk include only those children who walked only on the sidewalk or an off-street path. After the construction of the sidewalk network along Randall Road, only 5% of the child pedestrians were observed walking on the street or shoulder.

	Before SR2S construction	After SR2S construction
Child pedestrians on sidewalk only	172 (25%)	1,083 (95%)
Child pedestrians on street or shoulder	520 (75%)	63 (5%)

Note: The table above shows the number of observed children and, in parentheses, the percentage of children in the category as a percentage of total observed child pedestrians in the "before construction" or "after construction" periods.

The survey results give walking/bicycling mode splits for the trip to school of 31.99% before SR2S project construction and 21.55% after the project. This drop in walking/bicycling mode splits is statistically significant at the 5% level (t-statistic = 2.52), and is not consistent with the observed increase in child pedestrian activity after the sidewalk was built.

Differences in the distance from school among before and after survey respondents likely do not account for the disagreement between the survey data and the observational data. In fact, children whose parents returned surveys after SR2S construction lived closer to the school than did respondents to the "before construction" survey. In the "before construction" survey, 33% of survey respondents lived within ½ mile of the school, compared with 44% of respondents who lived within ½ of school for the "after construction" survey.

An alternative method of inferring the SR2S project's impact on walking is to examine responses to a question in the "after construction" survey that asked parents "Think about how often your child walked or bicycled to school before the project described above was built. Would you say that your child now walks or bicycles to school: Less, The Same Amount, More." Among survey respondents, 22 parents stated that their children walked to school more, 21 stated that their children walked to school less, and 74 said their children walked to school the same amount when compared with a year ago. Again, this result is more consistent with no change in walking travel than with the increased walking suggested by the observations. To infer the impact of the sidewalk improvement project, the research team analyzed the replies to this question by separating children into two groups—those who would walk past the SR2S project and those whose trip to school would not take them past the project. (The survey included a question that asked parents whether their children would walk past the SR2S project on the way to school.)

Among children for whom the new sidewalk was located along the route to school, 29% of those children's parents said their children walked more, compared with 7% who said their children who walked more if the SR2S project was not along their route to school. This difference, 22 percentage points, is statistically significant at the 1% level (t-statistic = 3.29). Looking at the percentage of parents who said their children walked less, among children for whom the new sidewalk was located along the route to school, 14.29% walked to school less, compared with 22% who said their children walked to school less among those for whom the sidewalk was not along the route to school. This difference, 8 percentage points, is not statistically significant (t-statistic = 1.12).

	Project along child's route to school	Project not along child's route to school
Percent of children who walked more	28.57%	7.41%
Percent of children who walked less	14.29%	22.22%

The results do not give a wholly consistent picture. Observed counts of child pedestrians suggest a large increase in walking near the school, reported mode splits from the survey suggest a decrease in the walk/bicycling mode split, and the question that asked parents to assess whether their child walked more, less, or the same amount than a year ago suggests that there was little net change in walking or bicycling travel in the full sample, but that children who would pass the sidewalk did walk more after the project was built. The bulk of the evidence is consistent with an increase in walking/bicycling travel after the sidewalk was built, even if the data are not completely consistent across the different measures.

Parent Perceptions

Among parents surveyed after the SR2S project was built, 69% replied that they believed the project made walking/bicycling safer and 65% stated that the project separated children from cars. Among survey respondents, 32% stated that the new sidewalk was the most important pedestrian/bicyclist safety project that could have been built near West Randall Elementary, while another 39% described the sidewalk as an important project.

Overall Assessment

The data show that the sidewalk improvement near West Randall Elementary School separated child pedestrians from vehicle traffic. The shift of observed child pedestrians from the street or shoulder onto the sidewalk was large both in percentage terms and in magnitude. The survey gives some evidence of increases in waking to school, especially when the data are split into two groups—children who would pass the project while traveling to school and those who would not pass the project. Overall, the bulk of the evidence suggests that the SR2S project increased the amount of pedestrian and bicycle travel near the school. Parent perceptions of the project are strongly positive. Both the objective data and the perceptions of parents suggest that the SR2S project near West Randall Elementary School was a success.

OVERVIEW AND CONCLUSIONS

This study gathered two types of data that can be used to evaluate the SR2S projects that were studied—objective data on traffic, pedestrian, and bicycle activity, and subjective data that reflect the opinions of parents and self-reported (by parents) behavior of children at the schools. Both data are reviewed here in assessing whether each of the nine projects was a success.

Expected Results

Each SR2S project had different expected outcomes, and the success of each project is gauged by whether the measured results matched expected results. Sidewalk improvement projects are generally not expected to slow vehicle traffic or reduce vehicle counts, while a bicycle path may not influence the amount of walking or the yielding of vehicles to pedestrians. While these generalizations might not hold for all SR2S projects, the different SR2S projects certainly had different expected outcomes. The following is a summary of the expected outcomes for each project studied in this report. In the table below, "+" denotes an expected increase after SR2S project construction, "–" denotes an expected decrease, and impacts denoted by (?) are less strongly expected than the other impacts.

Project Description and Expected Impact

Project Information			Expected Impacts				
			Walking/Bicycling Impacts		Traffic Impacts		
Project Type	School	Project Description	Amount	Location	Vehicle Counts	Vehicle Speed	Yielding
Traffic Control Devices	Cesar Chavez Elementary	Traffic light replaces 4-way stop sign	+ (?)	None	- (?)	-	+
Pedestrian/Bicycle Crossing	Glenoaks Elementary	In pavement crosswalk lighting	+ (?)	None	None	- [a]	+
Pedestrian/Bicycle Crossing	Jasper Elementary	In pavement flashing warning light [b]	+	None	None	-	+
Sidewalk Improvements	Juan Cabrillo Elementary	Pathway of decomposed granite with wood curb	+	On sidewalk	None	None	None
Pedestrian/Bicycle Crossing	Mt. Vernon Elementary	Pedestrian "countdown" crossing light [c]	+ (?)	None	None	None	None
Sidewalk Improvement and Bicycle Facilities	Murrieta Elementary	Sidewalk and bicycle path construction	+	On sidewalk	None	None	None
Sidewalk Improvements	Sheldon Elementary	Sidewalk gap closures (about 400 feet)	+	On sidewalk	None	None	None
Sidewalk Improvements and Pedestrian/Bike Crossing	Valley Elementary	Sidewalk gap closures (3,000 ft.) and crosswalk	+	On sidewalk	None	- (?)	+
Sidewalk Improvements	West Randall Elementary	Sidewalk gap closures (about 2,200 feet)	+	On sidewalk	None	None	None

Notes: "Location" refers to walking only, and whether walking occurs on sidewalk/path or street/shoulder. For location, "on -sidewalk" indicates an expected increase in walking on a sidewalk or path. Yielding refers to yielding of vehicles to pedestrians/bicyclists only. Expected impacts denoted by "?" are less strongly expected.

[a] At Glenoaks, note that traffic at the location of the crosswalk lighting system in front of the school, was congested before the improvement, which reduces the likelihood of further reductions in vehicle speeds.

[b] No traffic signal or 4-way stop was located at this intersection, before or after SR2S project construction. The warning light is in-pavement lighting.

[c] An existing traffic light was located at this intersection. Pedestrian "countdown" light shows time remaining before light changes.

The following project types are represented in the before/after analysis: Sidewalk Improvements, Pedestrian/Bicycle Crossings, Traffic Control Devices, and Bicycle Facilities. Two types of projects are not represented in the before/after analysis: Traffic Calming and Traffic Diversion. The study sites for those two project types (La Gloria Elementary, Hawthorne Elementary, and Sulphur Springs Elementary) had not finished SR2S project construction by the time data were analyzed for this report.

Measured Results

The results of the evaluation for each of the nine schools studied are summarized below. For each school, the summary highlights the outcomes that are expected to be key indicators of success. As examples, the traffic light at Cesar Chavez Elementary is expected to increase yielding of vehicles to pedestrians and the sidewalk gap closures or walking paths at Juan Cabrillo, Murrieta, Sheldon, Valley, and West Randall are expected to shift pedestrian traffic from a street or shoulder onto a sidewalk or path. The summary assessment below includes information about the most important outcome indicators, with an overall assessment of whether or not the project was a success. More complete data for each school are provided in Volume 2 of this report.

School	SR2S Work Type	Project Description	Evidence of Success	Summary of Measured Results and Comments
Cesar Chavez Elementary	Traffic Control Device	Traffic signal at intersection that previously had no signal	Strong evidence of success	Increase in yielding of vehicles to pedestrians; decrease in vehicle speed; in area with high amounts of walking (walk/bike mode split at school approximately 50%)
Glenoaks Elementary	Pedestrian/ Bicycle Crossing	In-pavement crosswalk lighting	Strong evidence of success	Increase in yielding of vehicles to pedestrians; pedestrian counts show increase in walking
Jasper Elementary	Pedestrian/ Bicycle Crossing	In-pavement crosswalk lighting	No evidence of success	No change in yielding of vehicles to pedestrians; simultaneous opening of I-210 Freeway extension confounds measurement for this project, as I-210 appears to have diverted traffic from SR2S site, which could be associated with the observed increase in vehicle speeds at SR2S site
Juan Cabrillo Elementary	Sidewalk Improvement	Walking path	Weak evidence of success	Shift in walking from street/shoulder to path, but little walking was on street or shoulder before SR2S construction; low walking rates (walk/bike mode split from 5% to 7%) and most pedestrians are children and parents who drove to school, park down the street, and then walk into school
Mt. Vernon Elementary	Pedestrian/ Bicycle Crossing	Pedestrian warning light at intersection that already had traffic signal	No evidence of success	No change in amount of walking; project's main effect might have been convenience, which is not well measured by the objective outcome indicators summarized here
Murrieta Elementary	Sidewalk Improvement and Bicycle Facilities	New sidewalks and on-street bicycle paths	No evidence of success	Very low walking/bicycling amounts before and after SR2S project construction

School	SR2S Work Type	Project Description	Evidence of Success	Summary of Measured Results and Comments
Sheldon Elementary	Sidewalk Improvement	Sidewalk gap closures	Strong evidence of success	Shift in walking from street/shoulder to path (34% of observed child pedestrians on sidewalk before SR2S project, compared with 65% on sidewalk after SR2S project); fast vehicle speeds on adjacent road (average from 30 to 40 mph) suggests large increase in safety from separation of pedestrians and vehicles; some evidence of increase in amount of walking
Valley Elementary	Sidewalk Improvement and Pedestrian/ Bicycle Crossing	Sidewalk gap closures and new crosswalk	Strong evidence of success	Shift in walking from street/shoulder to path (58% of observed child pedestrians on sidewalk before SR2S project, compared with 96% on sidewalk after SR2S project)
West Randall Elementary	Sidewalk Improvement	Sidewalk gap closures	Strong evidence of success	Shift in walking from street/shoulder to path (25% of observed child pedestrians on sidewalk before SR2S project, compared with 95% on sidewalk after SR2S project); high levels of walking before and after project; walking increased after SR2S project

Overall, the research team found strong evidence of success at five of the nine schools studied (Cesar Chavez Elementary, Glenoaks Elementary, Sheldon Elementary, Valley Elementary, and West Randall Elementary). Schools were classified as having strong evidence of success if the measured outcomes corresponded to expected outcomes, if the measured outcomes exceeded the sample error in the survey data or the estimated human error in data collection (as appropriate), if the data provide a consistent indicator of project success, and if the magnitude of impact was reasonably large. In the case of Murrieta Elementary, for example, even though the research indicated a large percentage increase in pedestrian counts, the "before construction" base was so small (2 pedestrians observed over two days of observation) that the observed increase (to 19 pedestrians over two days) was not judged sufficiently large to provide evidence of SR2S project success.

Note that these are strict, possibly overly strict, criteria for project success. These criteria require that a project produce a near-term, measurable impact that can be observed. Projects that contribute to behaviors that cannot be easily measured but that contribute to safety would not be ranked as a success by these criteria. For example, crosswalk lighting systems that increase driver awareness of pedestrians might not increase yield rates if yielding was already high and also might not measurably slow vehicle speeds if most vehicles slowed for pedestrians before the warning light. Given that collisions with pedestrians are rare events, an increase in safety from such a crosswalk lighting system could be real, but the measured outcomes of this study would not indicate that the project was a success. Similarly, projects that improve the walking environment in an incremental fashion, such as sidewalk gap closures in areas that were initially not conducive to walking, also would not rank as a success by these criteria, even if such projects were sensible parts of a long-term strategy to improve pedestrian or bicyclist activity and safety. Lastly, other events or programs could confound some SR2S project impacts. At Jasper Elementary, for example, the nearby opening of the I-210 Freeway extension diverted traffic from 19th Street, which could have masked any effect that pedestrian/bicycle crossing project might have had on slower vehicle speeds. Overall, the ranking of "strong evidence of success" likely understates the success of the SR2S program.

The rankings of success provide good comparative information. Some SR2S programs clearly delivered more immediate and measurable success than did others. A lack of immediate success does not necessarily indicate a failure of the project, however. The sidewalks and bicycle paths near Murrieta Elementary, for example, could be justified as necessary infrastructure that, with later improvements, might contribute to increases in walking and bicycling. In the quarter-mile circle around Murrieta Elementary, only 8 percent of the blocks had a complete sidewalk before the SR2S project—one of the lowest percentages of sidewalks at any school studied. Thus the sidewalks at Murrieta Elementary might be justified not

based on any prospect for immediate impact, but because the neighborhood had very poor walking infrastructure before the SR2S program. Similar statements might be made about other programs.

Against that backdrop, the fact that five of nine projects received a ranking of "strong evidence of success" suggests that the SR2S program on the whole was highly successful, as the value of the SR2S program is almost certainly underestimated by a simple count of programs that received a ranking of "strong evidence of success." In other words, the criterion for overall program success should not be that all SR2S projects deliver immediate and unambiguously measurable impacts, as that would not be possible even in the best of circumstances.

Evidence of Project Success by Work Type

The nine schools studies included four SR2S work types. Included are five sidewalk improvement projects, four pedestrian/bicycle crossing projects, one traffic control device project, and one bicycle facility project among the nine schools studied. Some patterns emerge from examining the evidence of project success across different work types.

Among the five sidewalk improvement projects studied, the SR2S sidewalk improvements at three schools (Sheldon, Valley, and West Randall) showed strong evidence of success. In all three cases, the success of the project was based primarily on large improvements in separating pedestrian traffic from vehicle traffic. At Sheldon Elementary, the fraction of children observed walking exclusively on the sidewalk increased from 34% before SR2S construction to 65% after SR2S construction. At Valley Elementary, the fraction of children observed walking exclusively on the sidewalk increased from 58% to 96%. At West Randall Elementary, the fraction of children observed walking exclusively on the sidewalk increased from 25% to 95%. These changes connote substantial safety improvements. Based on the experience at these schools, sidewalk gap closures at locations with moderate or heavy pre-existing pedestrian traffic are good candidates for SR2S funding.

Of the four schools with pedestrian/bicycle crossing improvements, the SR2S project at two schools (Glenoaks Elementary and Valley Elementary) showed strong evidence of success. The success of the project at Valley Elementary is based more on the sidewalk improvements than on the crosswalk. One of the more impressive outcome measures at Valley Elementary was the shift of pedestrians from the street or shoulder onto the sidewalk, which is likely due to the sidewalk gap closures. Thus, the only school where there is strong evidence of success for a pedestrian/bicycle crossing improvement is Glenoaks Elementary. While the measured success of the pedestrian/ bicycle crossing improvements seems less impressive than for the sidewalk improvement projects, note that the impact of pedestrian/ bicycle crossing improvements might be

more difficult to measure. To the extent that those projects increase driver or pedestrian awareness, safety could increase in ways that would not be measured by the methods used in this study.

The traffic control device, a traffic signal at Cesar Chavez Elementary, showed strong evidence of success. It appears that traffic signals that regulate vehicle yielding can produce important improvements in safety, especially near schools with a large amount of walking and bicycle travel.

The only bicycle facility, on-street bicycle paths near Murrieta Elementary, showed no evidence of success. There was little observed bicycling before or after SR2S project construction. Had there been more bicycle traffic before SR2S construction, the project might have had important value by separating that traffic from vehicles. As is, the bicycle path by itself appeared to do little to increase the amount of bicycle travel, suggesting that bicycle facilities might be restricted to either schools with moderate or high pre-existing levels of bicycle travel or to schools where a bicycle path brings a reasonable *a priori* expectation of increases in bicycle travel.

Overall, the most successful work types, based on the data summarized above, appear to be sidewalk gap closures in areas with pre-existing pedestrian traffic, or traffic signals in areas with large amount of both pedestrian or vehicle traffic.

Parental Opinion

The parent surveys revealed that parents at all schools had highly positive opinions about the SR2S projects. The survey responses to key indicators of parental opinion are summarized below.

School	Noticed project	Believed project made walk/bike safer	Believed project was most important or important	Believed project was most important
Caesar Chavez Elementary	82%	85%	76%	40%
Glenoaks Elementary	70%	77%	70%	51%
Jasper Elementary	86%	64%	68%	44%
Juan Cabrillo Elementary	82%	87%	63%	50%
Mt. Vernon Elementary	65%	71%	59%	37%
Murrieta Elementary	86%	85%	75%	60%
Sheldon Elementary	75%	84%	78%	44%
Valley Elementary	77%	77%	78%	50%
West Randall Elementary	69%	69%	71%	39%

The table above shows the percentage of survey respondents (parents of 3rd through 5th grade children at the study schools) who noticed the SR2S project, believed the project increased safety, and the percentage who ranked the SR2S project near their school as either the most important project possible or an important project. The last column shows the percentage of parents who ranked the SR2S project near their school as the most important project that could have been built.

Note that the SR2S projects fare very well when measured by parental opinion. Large majorities of parents at all schools noticed the project, stated that the project would increase safety, and had a favorable opinion of the project. In some instances, a larger fraction of parents stated that they believed they project would increase safety than stated that they noticed the project. In those cases, a few parents are likely offering a favorable opinion about the SR2S project based on the brief description in the "after construction" survey. Yet the description of the SR2S project in the survey was minimal, and was written in neutral terms that would not signal any judgment about the effectiveness or wisdom of the project. Hence, the strong positive opinion ratings shown above provide solid evidence of parental approval of the SR2S program. At all schools studied, a large majority of parents had a favorable opinion of the SR2S project near their schools.

Conclusions and Recommendations

Using data that are limited to measurable changes in vehicle or pedestrian/ bicyclist traffic, five of the nine schools showed strong evidence of success. This finding likely underestimates the beneficial impact of the SR2S program, as changes that are long-term in nature or that might increase driver or pedestrian/bicycle awareness could go undetected in the outcome data used in this study.

The SR2S projects were also broadly popular with parents at all nine study schools. In four of the nine schools, more than 50% of parents surveyed stated that the SR2S project was "the single most important construction project that could have been built" near their child's school. The lowest ranking for that question was at West Randall, where 39% of parents stated that the SR2S project was the single most important project that could have been built, and another 32% ranked the project as "important."

Overall, given the strong parental approval of the SR2S projects and the encouraging changes in traffic, pedestrian, and bicycle traffic, the research team concludes that the SR2S construction program has been successful in meeting its goals. It is the recommendation of the research team that the program be continued. Future SR2S funding cycles can build on the lessons learned in this evaluation. Specific recommendations include the following:

- Sidewalk gap closures near schools with moderate or high amounts of walking appear to be strong candidates for SR2S funding. Such projects are especially likely to produce increases in pedestrian safety.
- Traffic control projects that regulate yielding at intersections where large volumes of vehicle and pedestrian traffic intersect also are good candidates for SR2S funding.
- At schools where there are low levels of walking or bicycle travel, SR2S construction by itself will likely not be sufficient to increase non-motorized travel to or from school. At such locations, SR2S construction funding should be coupled with more intensive education campaigns or additional construction improvements at the schools to encourage students to walk or bicycle to school.
- In general, schools should be encouraged to leverage SR2S funds by providing education that encourages students to walk and bicycle safely to and from school. Including participation in National Walk to School Day as a criterion for evaluating applications for SR2S funding is one way to couple education more tightly with the construction program.

Future research should also continue to track the outcome of SR2S construction programs. Such future research can examine more long-term outcomes of SR2S construction. One example would be studies that would track accident rates, taking advantage of longer time series than would have been available in the research reported here.